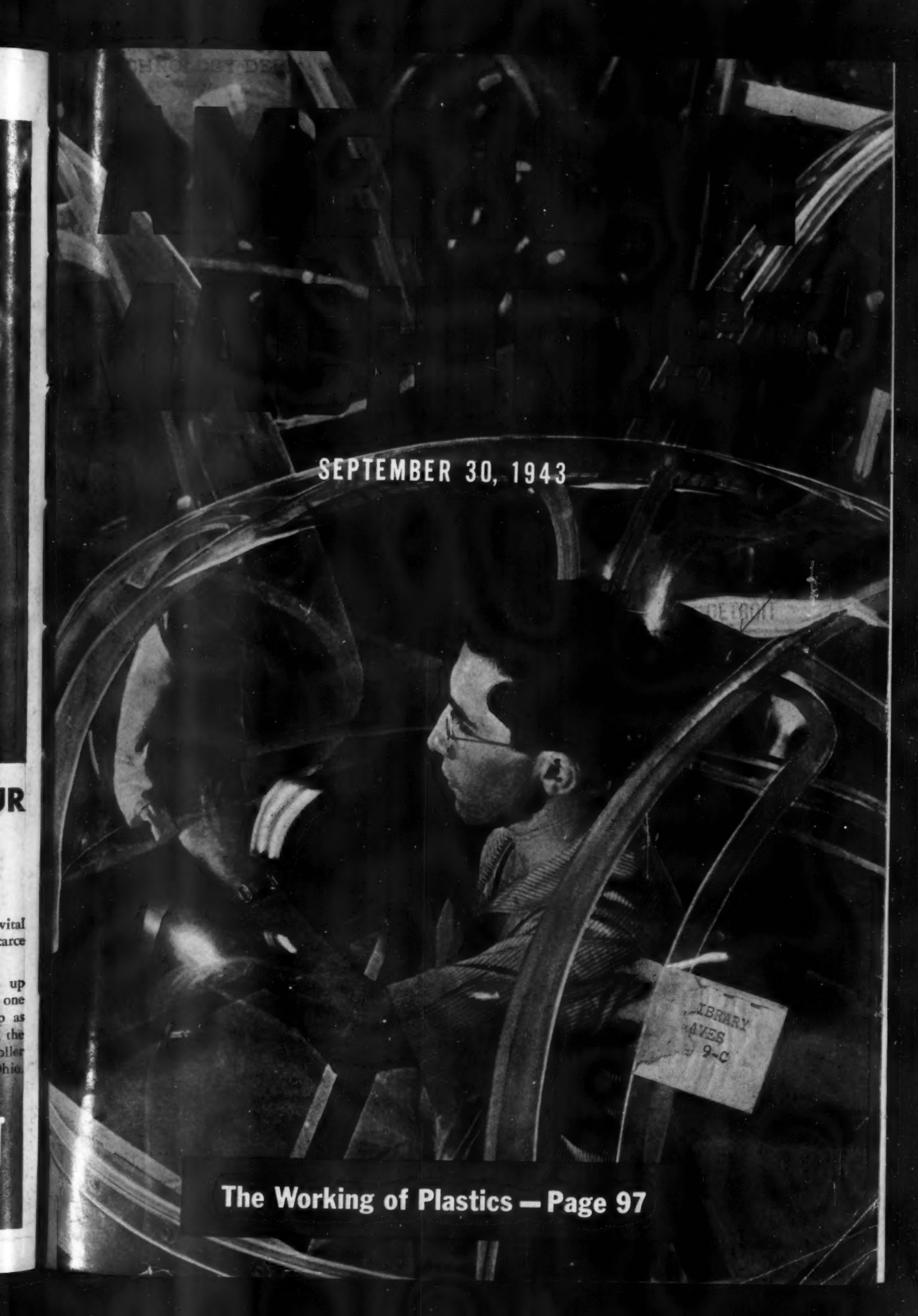
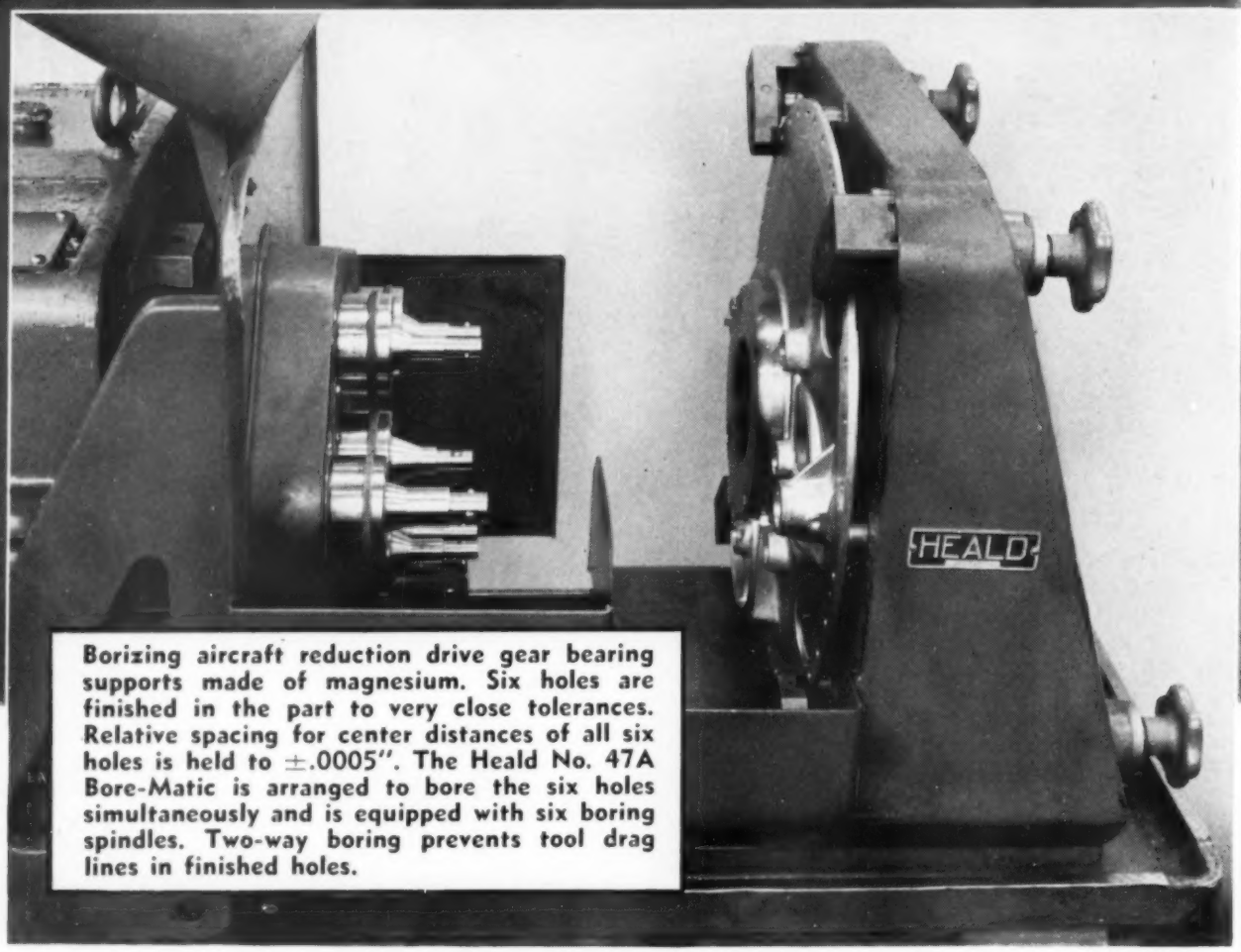


The Working of Plastics — Page 97

The Solution

TO MACHINING POST-WAR LIGHT-METALS . .



Borizing aircraft reduction drive gear bearing supports made of magnesium. Six holes are finished in the part to very close tolerances. Relative spacing for center distances of all six holes is held to ±.0005". The Heald No. 47A Bore-Matic is arranged to bore the six holes simultaneously and is equipped with six boring spindles. Two-way boring prevents tool drag lines in finished holes.

Today's precision *BORIZING* of Aircraft Parts

In aircraft plants, everywhere, Heald Bore-Matics are boring, turning, facing and grooving hundreds of light metal parts to precision tolerances . . . with a finish measured in micro-inches. The same Heald "know-how" that gave the aircraft industry precision finished at mass production speeds will give post-war manufacturers maximum precision and production in machining light metal alloys.

The same engineering organization that designed and developed means and methods for accomplishing the impossible on complicated war time products are available to you for today or tomorrow's problems. Make this department part of your organization.

Partial List of BORIZED Parts

- Bases
- Bearing Housings
- Camshaft Housings
- Covers
- Cylinder Heads
- Crankcase Sections
- Front Covers
- Gear Boxes
- Gun Turret Saddles
- Gyro Pilot Servo Bodies
- Instrument End Shields
- Magneto Housings
- Oil Pump Bodies
- Propeller Shaft Plugs
- Reduction Gear Cases
- Regulator Housings
- Speed Reducer Housings
- Supercharger Gear Casings
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The Heald Machine Company Worcester, Mass., U.S.A

For More Precision Faster bring your problems to Heald

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American Machinist

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AMERICAN MACHINIST —chips

Prelude to Post-War . . . Departing a bit from our customary fortnightly menu of variety items, we'd like to devote this upper portion of the page to some thoughts on what lies ahead for producers of metal goods.

In talking to manufacturers, scanning reports of developments and bending an occasional ear to "off the record" comments of the high-ups, it seems increasingly certain that there will be no such thing as a "post-war hour" for Metal-Working. That is, the common conception of an undetermined day when the alighting dove of peace shall cause industry to do a sudden flip-flop back to normal production.

The signs point, instead, to a series of "Reconversion Points" for various divisions of the industry . . . or individual plants within those divisions. In other words, as armament quotas on this item or that are achieved, sections of industry will turn to the manufacture of certain civilian goods.

This is already happening in some essential lines of our domestic economy. Transportation, for instance, in which enough facilities and steel have been provided to bolster our railroad equipment . . . including 5,801 more freight cars this year. The ODT reports that replacements of civilian trucks is failing to keep pace with retirements . . . and this can only be allowed to go so far. Vital wheels must be kept rolling.

Farm equipment is another case in point. This year, farmers overcame inadequate equipment and a labor shortage to provide a near-record crop . . . but how about next year? No two ways about it . . . builders of farm machinery and implements must devote at least a part of their capacity to making enough agricultural equipment to see us through.

Still a third example is found in household goods. WPB found it advisable to allot 125,000 tons of steel for the last three months of this year for manufacturing a variety of important civilian articles . . . including coffee pots, stoves, garbage cans, bedsprings and hotwater heaters.

This is not the beginning of a manufacturing spree to interfere with the war effort. It's just that some "civilian" products have become war products, and more are likely to follow as this struggle of attrition wears on.

Metal-Working has shown itself fluid enough, versatile enough, to meet these changing conditions. As a result, the impact of peace will be lessened, and a fairly steady flow of business maintained in the industry as a whole.

The picture in each individual plant, naturally, depends on how it is now tied into the war effort, what the future tides of battle may dictate in the way of switched war requirements and which civilian products may be deemed essential. But every production man should, we believe, realize that this state of flux and gradual change *does* exist . . . and consequently keep himself in readiness for what may come.

That means, for one thing, keeping in close touch with developments that occur in all types of tools and production machinery. It means watching trends in the use of various types of parts and new materials, and gaining experience in working with them.

This is a war of movement, on the battlefields and in our industrial organization. That's why it is so very important to keep *fully informed* and ready to move in the right direction. *American Machinist's* job, editors and advertisers, is to help bring you that information.

Now There Are Five . . . *Below you see the first group portrait of our family of employee-training aids, "The Tools of Our Trade". Reading from left to right, Small Tools, Drilling, Milling, Engine Lathe and Grinding (the newest). About 50,000 of these guides on fundamental shop practice are now at work helping make skilled operators out of green hands. We have thousands more on the shelf, ready to help in your plant when you say the word. Still available at 10c per, slightly less in lots of 500 or more. Just write us.*

The TOOLS OF OUR TRADE
How to Run a DRILLING MACHINE
How to Run a MILLING MACHINE
How to Run an ENGINE LATHE
How to Run a GRINDING MACHINE

AVOID DISTORTION WHEN YOU QUENCH

MANY precision parts must be quenched to obtain necessary strength and hardness. An uncontrolled quench, however, results in distortion, which either destroys previously machined accuracy, or necessitates leaving excessive stock to be removed after hardening.

Gleason quenching presses eliminate both of these undesirable conditions by providing a *controlled* quench which holds distortion to a minimum. The principle is simple—the work is held between dies and aligned while still plastic. It is then submerged, and the dies allow normal contraction, while directing the flow of quenching oil so that an absolutely uniform quench is obtained. The rate of quench may be regulated as desired, down to a few seconds per part. An automatic timer returns the work to loading position, assuring uniform length of quench for all parts.—All the operator does is to load the press and push the button.

Manufacturers are finding Gleason presses ideal for a variety of work—gears, discs, lines, bearing cups and cones, —even such parts as crankshafts and breech blocks.

The presses are made in two sizes, 15" and 25", for parts up to these respective diameters. The 25" press can be supplied with a roller fixture attachment for quenching shafts and integral shaft pinions up to 22" length.

Let us show you how a Gleason quenching press can solve your quenching distortion problems. Write for information or, better yet, send prints of the parts you want to quench.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

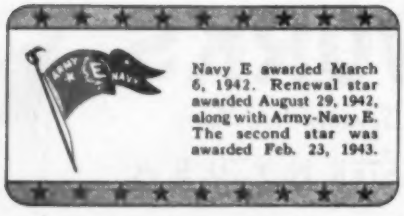
1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

CINCINNATI

TALK

Illustrated at the right is a good example of how an all-Cincinnati team (a CINCINNATI No. 3 Plain Dial Type Miller and CINCINNATI Engineered Fixture and Cutters) stepped up production by reducing set-up time for handling two distinct milling operations on airplane engine crankshafts.

In the first setting (left hand illustration on the opposite page) a 45° clearance is milled for a bearing collar. At the completion of this operation, adjustable fixture elements are rearranged and the cutter changed by means of the quick change equipment. The work is then adjusted to the cutter and everything is all set for the next operation of milling a 24° angle on one cheek, as shown in the right hand illustration on the opposite page. ¶ Several outstanding characteristics of the CINCINNATI Dial Type also contribute toward the quick change-over from one operation to another. The *right speed* for type and diameter of cutter as well as the *right feed* for material and cutter, are quickly selected by power, without effort, at the front or rear, if desired; rapid adjustment of work to cutter with three way power rapid traverse. ¶ Time-saving teams of fixture, cutters and machine are specialties with the service engineers here at Milling Headquarters. These authorities will be glad to analyze your milling problems, and you may be sure they will present a satisfactory solution. ¶ For complete information on CINCINNATI Plain, Universal and Vertical Dial Type Milling Machines, write for specification catalog M-970-2. For a brief description of these machines or a look at the complete line, consult Sweet's Catalog File. ¶ Illustrated at the upper left is a CINCINNATI No. 3 Plain Dial Type Miller.

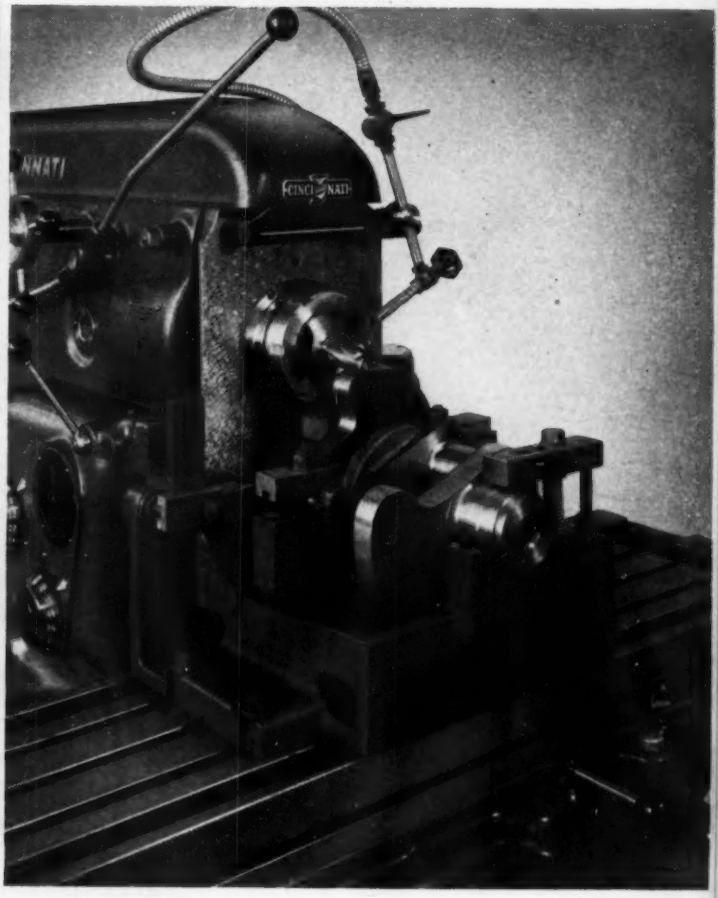


Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

THE CINCINNATI M

MILLING MACHINE

K ABOUT TEAM WORK!



MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

• BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

"That Yankee gun they load on Sunday fo

These cynical and war-weary words were a Confederate soldier's description of a famous weapon of the Civil War. It was the Henry Rifle — a Yankee answer to a national emergency, back in the days of muzzle-loaders.

Benjamin Tyler Henry, the gun's inventor, was considered one of the greatest gunsmiths of the 19th century, and he helped to found the fame of Jones & Lamson in the early days of American industry . . . while the gun, in turn, commenced the fame of a great American company as the first of the world-famous line of Winchester Repeating Rifles.

Many of industry's most important companies and products have stemmed from the men and the machine tools developed by Jones & Lamson — America's oldest machine tool company.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of • **Universal Turret Lathes** • **Fay Automatic Lathes** **Automatic Thread Grinders** • **Optical Comparators** • **Automatic Opening Threading Dies**

Springfield, Vermont, **U. S. A.**

FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS

OPTICAL COMPARATORS

AUTOMATIC OPENING THREADING DIES

ay for the rest of the Week!"

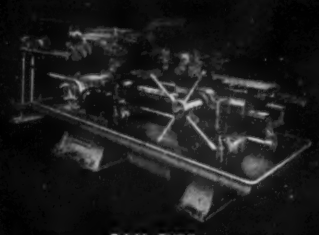
It was on a Sunday that America looked up from the tragedy of Pearl Harbor and asked her industries for a Yankee gun — Today, Jones & Lamson machine tools and engineering are again helping to produce many Yankee guns such as this world has never seen before.

And after the war is over, our engineers and service men will play an important part in helping industry to convert to peacetime production . . . when new companies and products will once more stem from the men and the machines of America's oldest machine tool company.

J&L

PROFIT-PRODUCING
MACHINE TOOLS

SADDLE TYPE
UNIVERSAL TURRET LATHES



RAM TYPE
UNIVERSAL TURRET LATHES

GEAR

Official U. S. Navy Photograph

WAR PRODUCTION BULLETIN

One of the Gear Shapers "choicest" chores is the cutting of

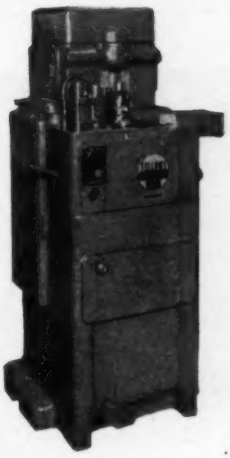
TORPEDO FUSE AND DRIVE MECHANISM GEARS . . . .

Precision-made, yet in destroying themselves they honor the workmen who made them, and the Navy men who risk their lives in using them.

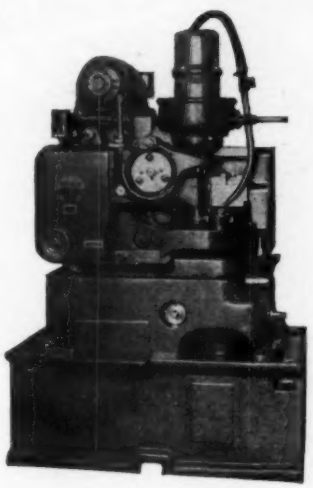
FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

SHAPER CUT GEARS HELP Blast TOJO'S SHIPS



The torpedo's mission is accomplished in a moment's impact on an enemy objective. A ten thousand dollar bundle of destruction, expertly launched from an U. S. plane, ship or submarine, it depends for its unerring accuracy upon the finest of precision in its operating mechanism . . . In this, gears play a vital part, not only in the drive of the high-speed propulsion mechanism, but also as components of the fuse mechanism. For their task of helping blast Tojo's ships, and Schicklegruber's subs, these gears are being cut on Fellows Gear Shapers. We've always been proud of the Gear Shapers' productive capacity, but never more so than when they do their bit to bring the day of victory closer . . . For a complete line-up of Fellows products, ask for a copy of our general catalog, "The Fellows Method", write: The Fellows Gear Shaper Company, Springfield, Vermont —or 616 Fisher Building, Detroit, Michigan, or 640 West Town Office Building, Chicago, Illinois.

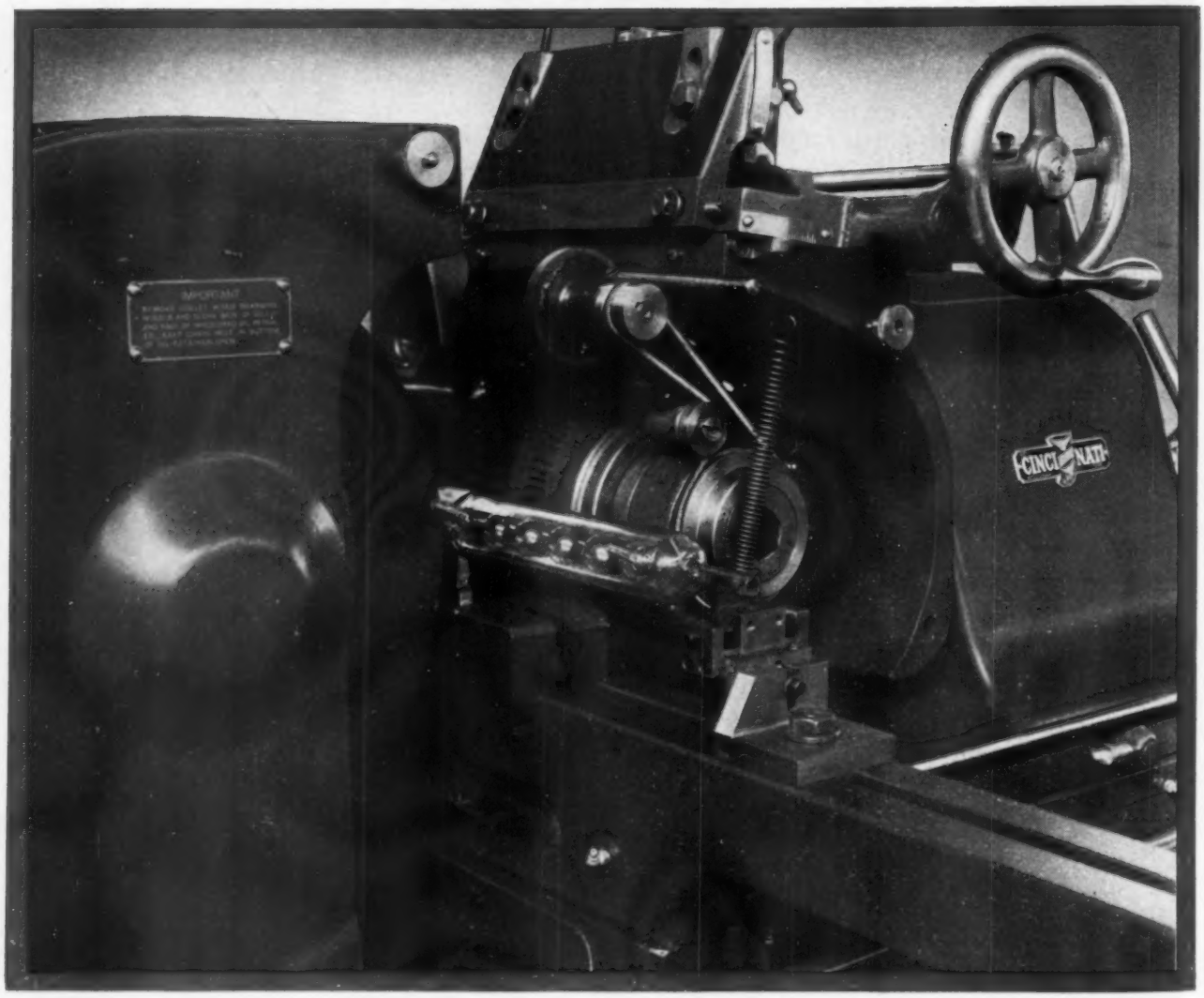


Method

. . . . FROM BLANK TO FINISHED GEAR

Did you know you can

GRIND



Close-up of CINCINNATI No. 2 Centerless grinding glass condenser tubes. Specification catalog G-456-1 gives complete information on the machine. A copy will be sent on request.

Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

CINCINNATI

CENTER TYPE GRINDING MACHINES

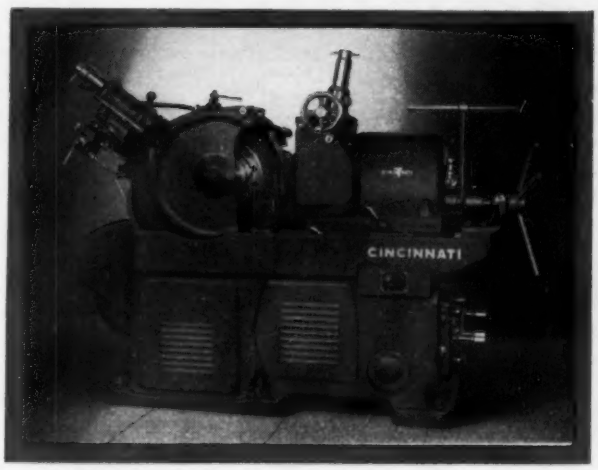
Glass

CINCINNATI

ON A CINCINNATI CENTERLESS?

Grinding parts made of non-metallic substances such as glass, hard rubber, plastics, cork, may often be quickly and easily accomplished by the centerless method. The illustration at the left is a good example. Here the taper end of glass condenser tubes is being centerless ground. The tubes vary in size up to 16″ long, and are rather frail and easily broken. This difficulty was overcome by equipping the machine with a simple auxiliary drive for helping the tube to rotate. A swivel bracket mounted on the end of the regulating wheel spindle, carries a rubber faced wheel which contacts the work. Breakage was reduced to almost zero, while production jumped way ahead of the former method.

Working out tough grinding problems is a specialty with the engineers here at Grinding Headquarters. If you have a problem involving either the centerless or centertype methods, put it up to the CINCINNATI Service Engineers.



Front view of the CINCINNATI No. 2 Centerless Grinding Machine. Brief description and specifications may be found in Sweet's Catalog.

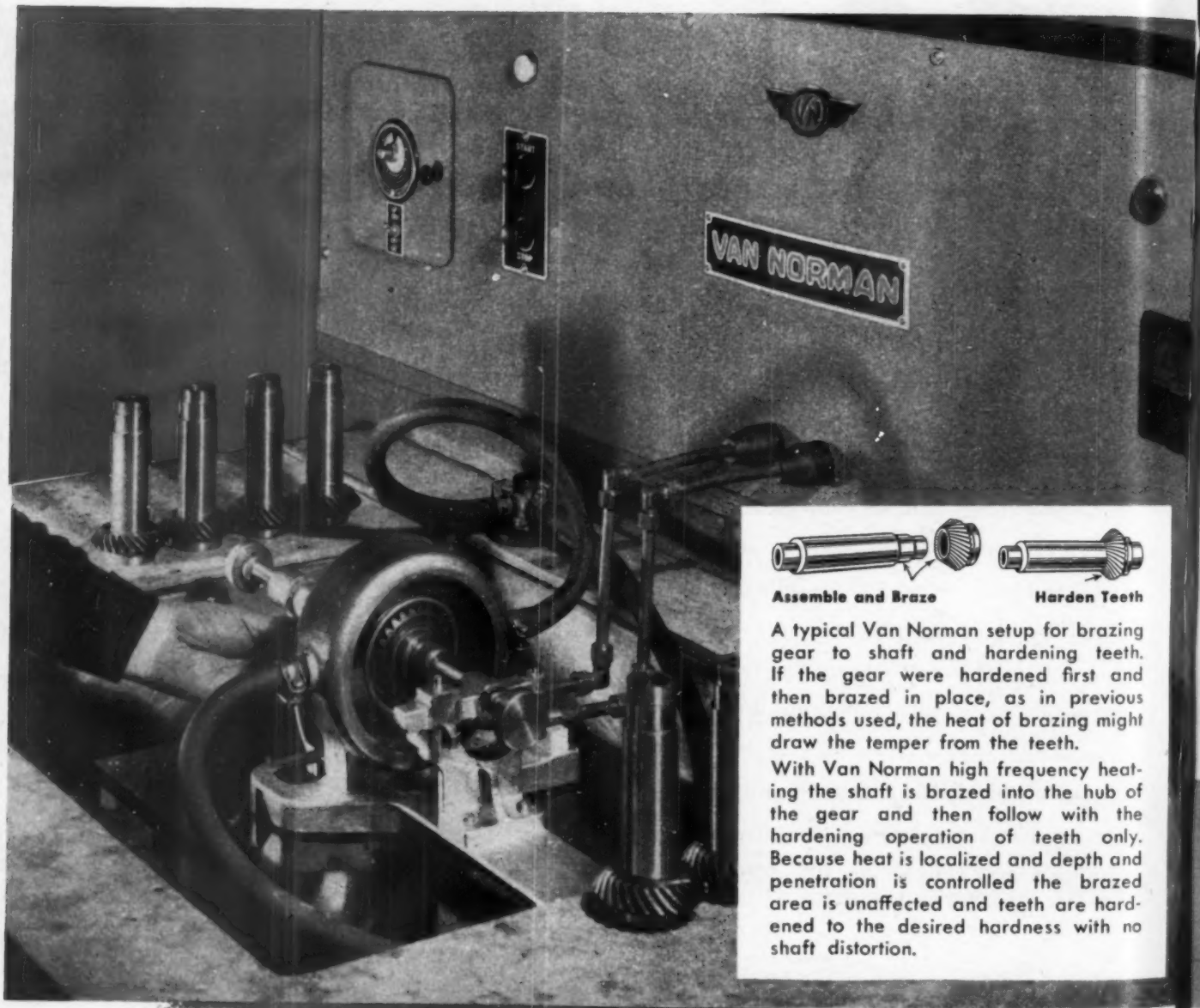
GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

You too, can use . . .

VAN NORMAN



Assemble and Braze **Harden Teeth**

A typical Van Norman setup for brazing gear to shaft and hardening teeth. If the gear were hardened first and then brazed in place, as in previous methods used, the heat of brazing might draw the temper from the teeth.

With Van Norman high frequency heating the shaft is brazed into the hub of the gear and then follow with the hardening operation of teeth only. Because heat is localized and depth and penetration is controlled the brazed area is unaffected and teeth are hardened to the desired hardness with no shaft distortion.

"It pays to Van Normanize"

HIGH FREQUENCY INDUCTION HEATING

Practically every plant, large or small can profitably use the Van Norman Induct-O induction heating converter for production or small lot hardening, brazing, soldering, annealing and other selective heating applications.

Because Van Norman Induct-O localizes heat to a specific area or portion of metal it not only simplifies the heating operation but completes most jobs in seconds instead of minutes or hours. In addition, it eliminates the necessity and expense of heating the entire part. The ease of operation makes it possible for practically any ordinary worker to operate the machine, and since the entire heating operation is automatic, part after part is turned out with identical characteristics. A few of the various operations performed on Van Norman Induction Heating Equipment are shown below.

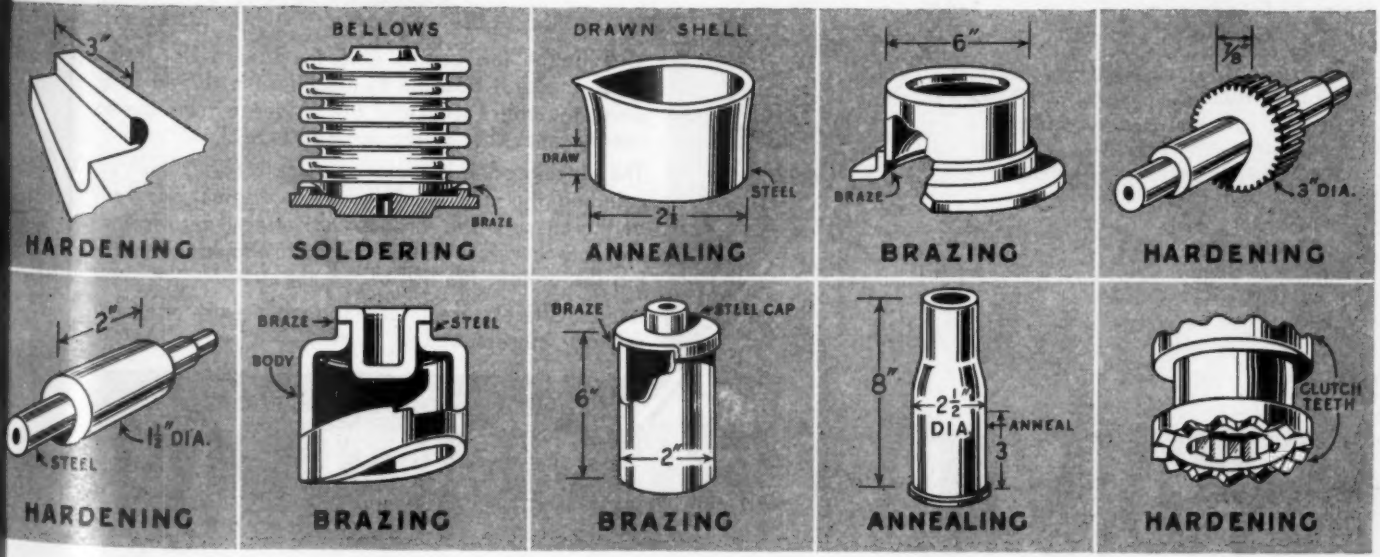
Get the story on the Van Norman Induct-O, today. See how you too, can use high frequency induction heating.

ARMY E NAVY

VAN NORMAN COMPANY

ELECTRONICS DIVISION

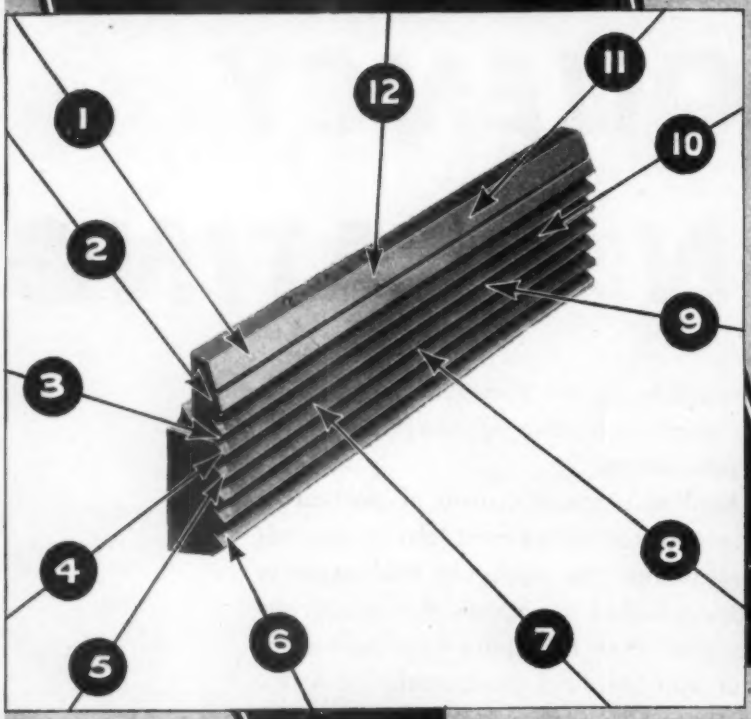
SPRINGFIELD, MASSACHUSETTS



Acclaimed..

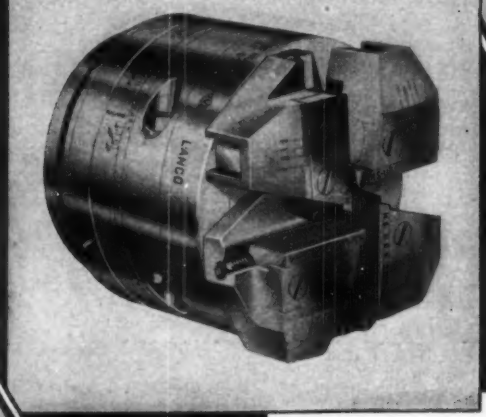
The Finest Thread Cutting Tool in Industry

The LANDIS CHASER



Used Exclusively in LANDIS Die Heads and Threading Machines

LANDIS



1-Permanent throat permits close to shoulder threading throughout life of chasers

2-Rake angle range covers all machinable materials

3-Free cutting condition permits maximum cutting speeds

4-Simple grinding operation renews entire cutting edge and leading feature

5-Line contact with work lessens friction and minimizes thread distortion

6-Leading feature insures thread of accurate lead

7-Lateral absorption of cutting strain reduces vibration and chaser breakage

8-Right and lefthand threading feature reduces chaser equipment

9-Standard chasers thread all diameters with proper chaser holders

10-Interchangeability of chasers lowers operating cost

11-Chaser length provides exceptionally long life and low tool cost

12-Permanent throat gives equal distribution of cut

The life of the Landis Chaser, due to its design which makes it possible to machine the thread form along the entire length of the chaser, is from ten to twenty times that of the hobbed type die.

The cutting edge is renewed completely at each regrinding thereby maintaining the original accuracy of the chaser. The throat is not altered by regrinding and therefore permits close-to-shoulder threading throughout the life of the chaser.

Landis Chasers are interchangeable—any one of a set may be replaced.

LANDIS MACHINE COMPANY

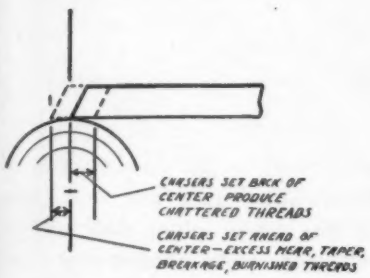
LANDIS TRADE—MARK REG. U.S. PAT. OFF.

THREAD TIPS

A Good Mechanic Knows and Cares For His Machine

In the Interest of Efficiency, Better Workmanship and Higher Production

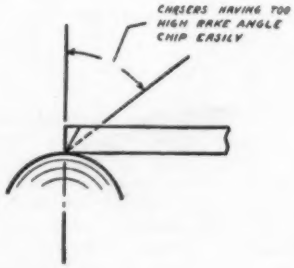
LIFE OF LANDIS TANGENTIAL CHASER IS MATERIALLY INCREASED BY ELIMINATING REASONS FOR MECHANICAL FAILURE


CHASERS SET BACK OF CENTER PRODUCE CHATTERED THREADS
CHASERS SET AHEAD OF CENTER—EXCESS WEAR, TAPER, BREAKAGE, BURNISHED THREADS

SETTING CHASERS TOO FAR OVER CENTER OF ROTATION CAUSES EXCESS WEAR

The chaser setting gauges for Landis Die Heads are designed to set the chasers theoretically upon cutting center. However, due to the hardness of material and the variation in the machineability of materials, it is frequently necessary for the user to alter the chaser setting position slightly to obtain satisfactory results. The chasers should be set uniformly with a gauge and then checked for "radial" with a scale. If the chasers are set too far over center, they will tend to burnish the thread and wear excessively back of the cutting edge, thus making it necessary to grind away an unusual amount of the tool to bring it to the cutting edge. If the chasers are too far back of center they will tend to dig into the work, thus causing the chasers to chip frequently and require frequent regrindings.

CHASERS HAVING TOO HIGH RAKE ANGLE CHIP EASILY

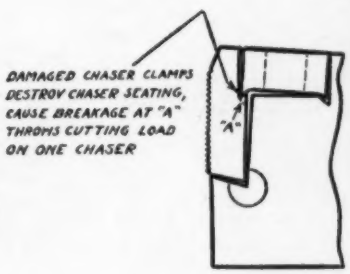


The correct rake angle for any given material is best determined by experimentation. The lowest possible rake angle consistent with good thread quality is recommended to eliminate frequent regrindings. Chasers having a rake angle which is too high chip easily on the cutting edge, in such a manner as to give the chaser the appearance of being too soft. This condition frequently results in users complaining that the chasers are not sufficiently hard.

Mechanical Causes of Chaser Chipping

Thread-cutting and other tools made from high speed steel are frequently misused with the result that mechanical failure occurs. The users of Landis Thread Cutting die heads and thread cutting machines will obtain the maximum operating efficiency from this equipment, the longest possible life, the lowest cost and best quality of thread form from their chasers by eliminating the following reasons for mechanical failure.

DAMAGED CHASER CLAMP AND HOLDER THROW ALL DUTY ON ONE CHASER



In the rush of production, operators of die heads are sometimes inclined, when interchanging chasers, to be careless in failing to remove the accumulation of fine cuttings and dirt from beneath the chaser clamps. Furthermore, chips will sometimes lodge in the dovetail of the chaser. The action of clamping down on this accumulation of chips will bruise or raise high spots along the clamping surface of the chaser clamp with the result that the chaser will be prevented from seating properly in the chaser holders. If a chaser fails to seat properly, it will be thrown out of its proper alignment, resulting in poor qualities of thread finish and unusually rapid wear of the chaser.

To prevent excess wear, inspect the chaser clamps and chaser holders periodically, removing all bruises or high spots with a hone. The chaser clamps should never be ground.

Be Threadwise—Employ LANDIS Long Life Tangential Chasers

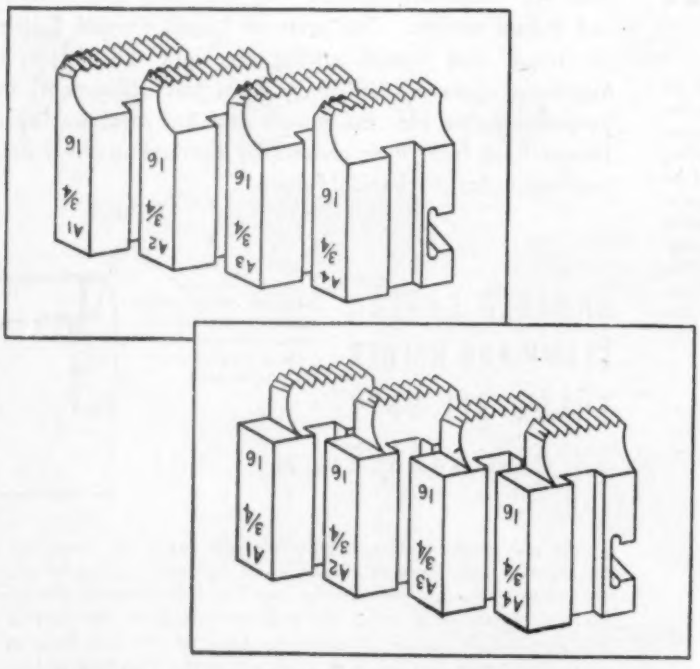
WAYNESBORO · PENNA · U·S·A·

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

GEOMETRIC Pointers FOR SAVING HIGH SPEED STEEL

SALVAGE ALL WORN-OUT CHASERS

HIGH SPEED STEEL IS PRECIOUS!



Above is shown how a set of chasers with worn or chipped teeth (top illustration) can be recessed and made serviceable for many more jobs of thread production. After recessing the chasers must be rechamfered and, if the entire cutting face is dull, it should be touched up slightly, removing only .002" or .003".

High speed steel is hard to get. Don't waste it! Buy only the chasers you require and keep them on the job until they have "given their all" in thread production. Many times, chasers with worn out or chipped teeth can be salvaged by recessing the front face as shown in the illustration.

But prevention is better than salvage. Don't let your chasers run into a shoulder and break. Resharpen them regularly before they become dull or start to turn out inaccurate threads. And finally when they will no longer cut passable threads, don't put them in with the general scrap. Segregate all high speed scrap and return it to the mills or dealers that specialize in high speed steel. The Geometric Tool Company, New Haven, Connecticut.

The Geometric Tool Company is listed on the Treasury Department's Roll of Honor of those companies whose employes contribute at least 10 per cent of their earnings, through the Payroll Savings Plan for War Bonds. Buy War Bonds and Stamps each payday! Our soldiers, sailors and marines are GIVING their lives. Surely you can LEND your money!

P&J's

40 YEARS OF "KNOW-HOW" IN PRODUCING DUPLICATE PARTS...

. . . a valuable asset in speeding war production

The remarkable war-materiel production figures that are released from time to time are evidence that somewhere back in the metal-working shops of this Nation men and machines have been busy applying better ways and means for turning out an almost unlimited variety of parts for the machines of war. For tanks, planes, guns, motor vehicles, ships and shells are an assembly of parts.

P & J Automatic Chucking Equipment was developed many years before the present war, for turning out duplicate parts accurately and in quantity. P & J engineers have been applying their long experience toward achieving faster and faster parts production. The result has been a valuable contribution to today's war effort. The outstanding records for which the entire metal-working industry can well be proud have been made possible by organizations which, like P & J, have devoted their all in time, effort and technical skill to the problem of attaining more and better production.

The POTTER & JOHNSTON MACHINE CO.

Pawtucket, R. I.

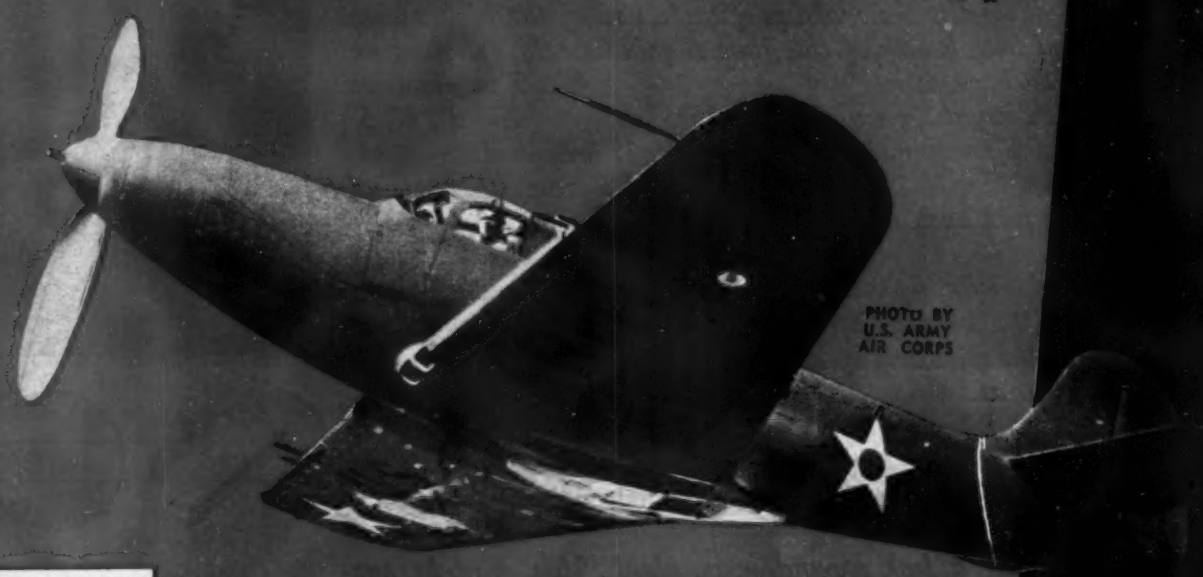
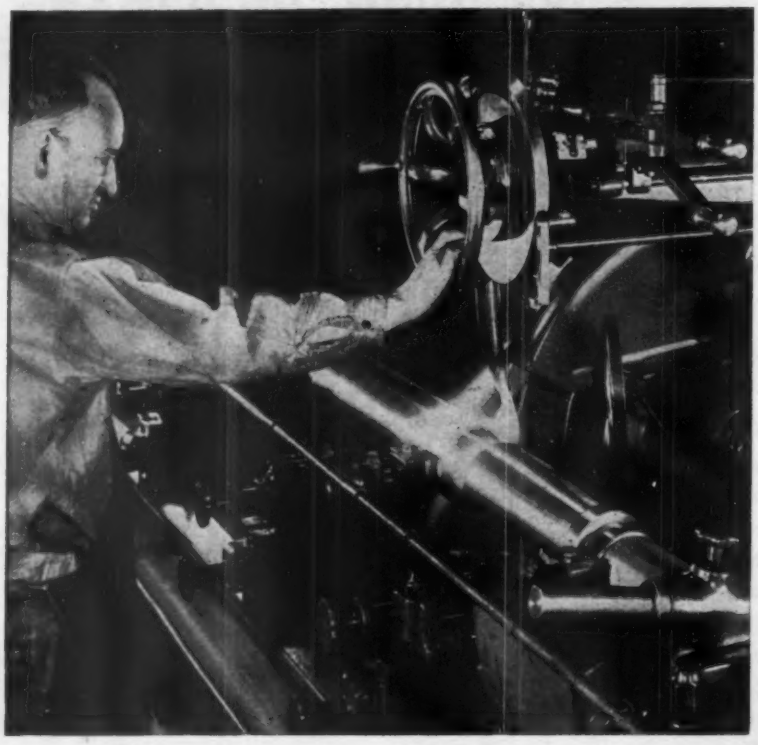


PHOTO BY U.S. ARMY AIR CORPS

Our Boys are Buying Bonds and FIGHTING—

What are you doing?

LET'S GET DOWN



Left:--A close-up showing the grinding of a boring machine spindle. When finish grinding a limit of .0005" is required, but the work is actually held within a limit of .00025".

Yes, let's get down to brass tacks with an example that will illustrate just why a number of manufacturers have turned to the Landis Type B Plain Hydraulic for certain grinding needs. Take the 20" x 240" Type B Machine in the plant of a well-known maker of large machine tools.

How does he make profitable use of the high swing and long length of the Type B grinder? By grinding on it such parts as boring mill spindles 4" to 9" in diameter with lengths varying up to 15' 5", boring bars 3", 4", 5" and 6" in diameter and from 4' to 15' long and car wheel lathe spindles 19" in diameter and 3' long. When grinding jobs such as these practically the entire capacity of the machine is employed. In addition other smaller parts with lesser dimensions are often ground.

The rugged Type B Plain Grinder is recommended for the grinding of a number of large and heavy parts such as rolls, printing cylinders, large motor armatures, large lathe spindles, tank gun rotors, shafts and car axles. It is often supplied with a gapped table for grinding work having projections as, for instance, locomotive piston rods and valve yoke stems.

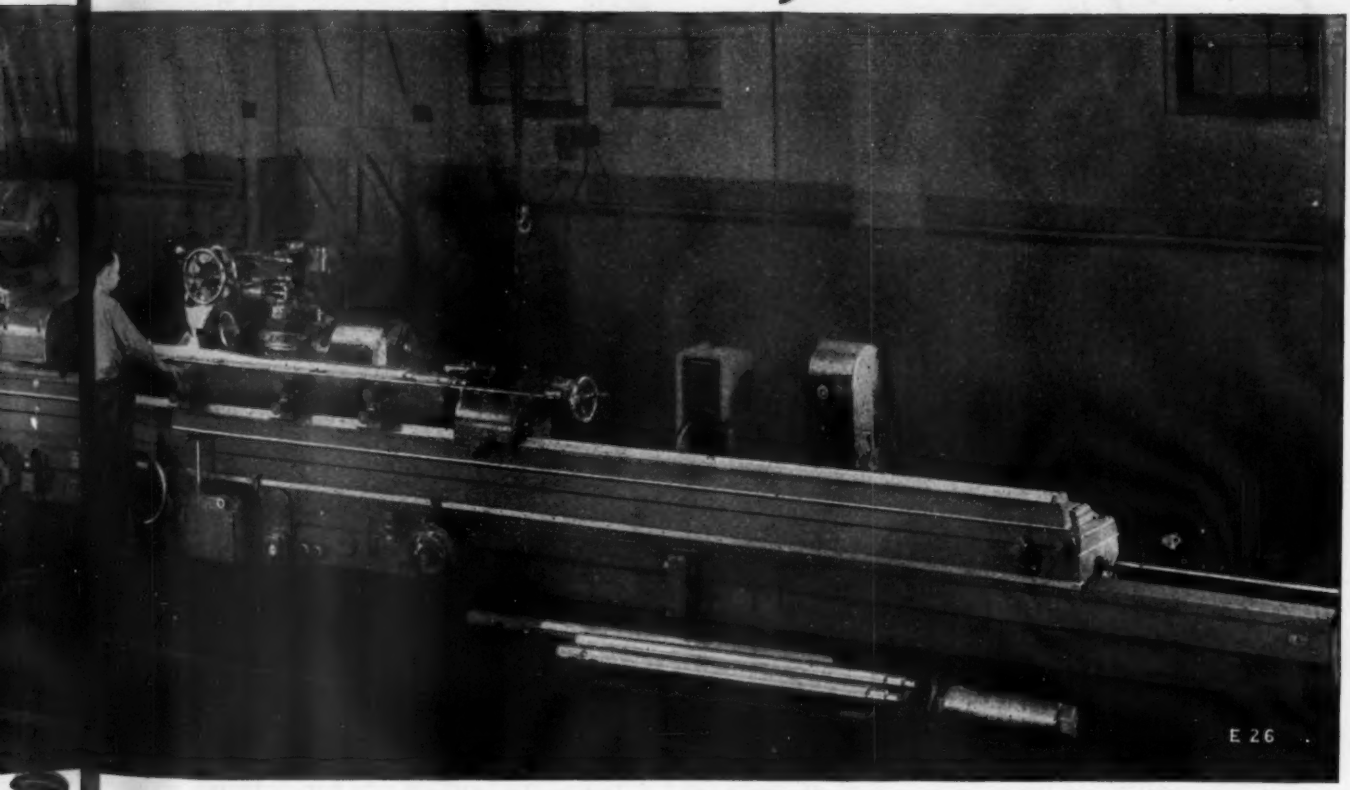
Take a look around your plant. You may be surprised at the uses you will find for this heavy and massive machine.

PRECISION LANDIS GRINDERS

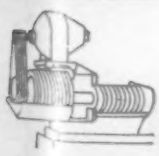
Unusual Performance As Usual

TO BRASS TACKS

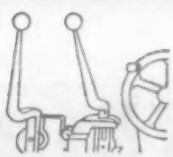
Below:--The Landis 20" x 240" Type B Plain Grinder in the plant of a leading machine tool manufacturer. This machine is ideal for grinding a variety of long heavy work.



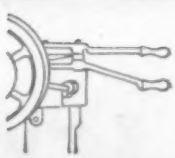
LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA



MULTIPLE V BELT HEADSTOCK DRIVE



HYDRAULIC WORK TABLE TRAVERSAL WITH STEPLESS SPEED RANGE

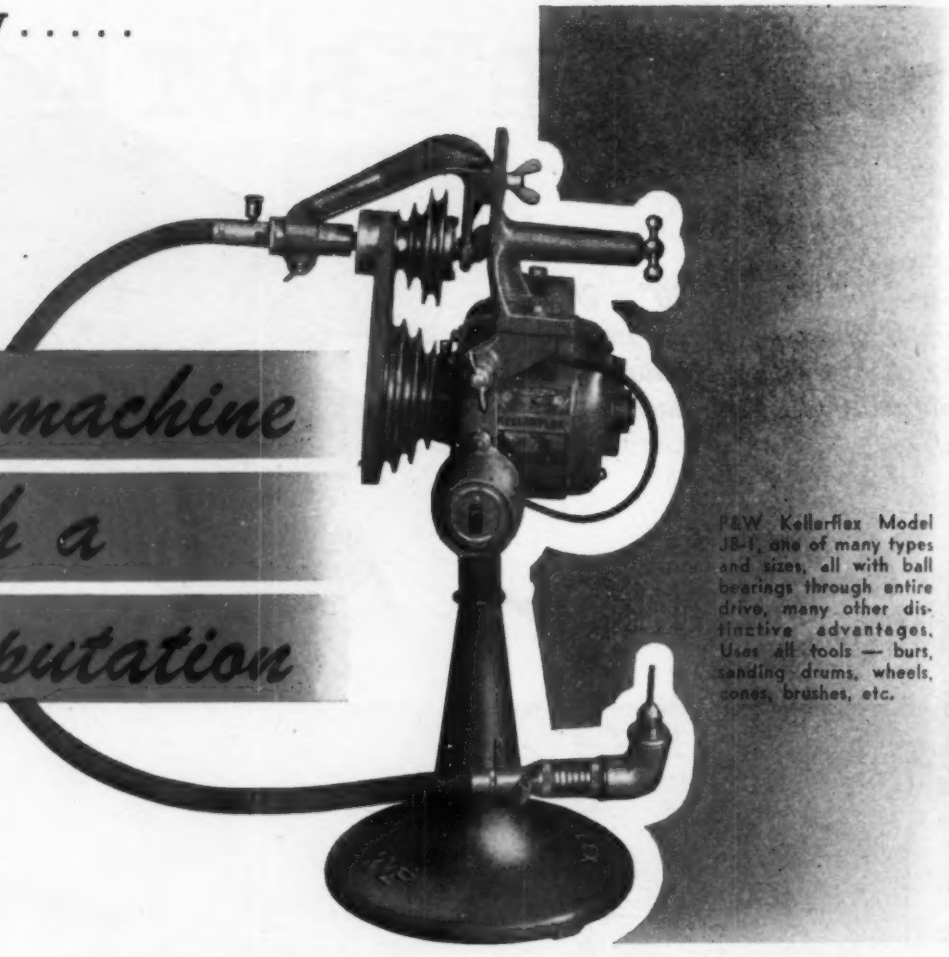


RAPID ELECTRIC WHEEL FEED

387

Prompt Delivery . . . . .

A little machine with a Big Reputation



P&W Kellerflex Model JB-1, one of many types and sizes, all with ball bearings through entire drive, many other distinctive advantages. Uses all tools — burs, sanding drums, wheels, cones, brushes, etc.

BY COMPARISON with other Pratt & Whitney machines, the P&W Kellerflex is little . . . but it's doing some mighty big jobs, and has earned a big reputation.

Kellerflex has the same top qualities you'd expect of equipment built by the makers of such super-accurate machine tools as P&W Jig Borers, Gear Grinders, and the rest. It's a flexible shaft machine — with a difference: *stamina, strength, extra* ease of handling. Built in many sizes and types, with a full line of accessories, Kellerflex handles countless tough jobs — buffing, burring, drilling, grinding, die finishing, polishing, lapping, sanding, snagging, wire brushing, and many others.

Of course you want to use flexible shaft equipment to speed production, save manpower, improve quality. When you buy, choose *Kellerflex* for *long, dependable* service . . . then you'll be equipped for a flying start at your post-war production. Write for details. Thanks to increased facilities we offer PROMPT DELIVERY to priority-holders. PRATT & WHITNEY, *Division* Niles-Bement-Pond Company, West Hartford, Conn.

KELLERFLEX

CENTER SCOPE, the optical locating tool, makes accuracy a habit regardless of who uses it . . . It locates edges on layouts to "within a tenth" — does it fast — and the operator can see that he is right!

The Center Scope can be used on any machine tool and provides an easy method to compensate for spindle or adaptor run-out.

It is a precision instrument not affected by wear, temperature or mechanical pressure. In addition to its many advantages, it is attractively priced. You can get your Variable Center Scope for only $97 f.o.b. Los Angeles, Calif.; Edge Block is $23 additional. Other models slightly higher.

For further details write for Bulletin No. 201-A.

Buy Victory with at least 10% in War Bonds!

Rotary Head Milling Machine
•
Autometric Jig Borers
•
Center Scope

Kearney & Trecker Products
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
•
Milwaukee Midgetmill
•
Milwaukee Speedmill

This Letter Wastes your time and Ours, too

Norton Company
Worcester, Massachusetts

Gentlemen;-

Please rush us at once by air express a new feed screw for a Norton external grinder. We must have part within one week as we are starting on a Government sub-contract for the U. S. Navy.

Your prompt attention to this order will be very much appreciated.

Sincerely

I.B. Pompous

I.B. Pompous
Chief Purchasing Agent

GRINDERGRAM

Use a flood of coolant directed onto the contact point when truing, thus keeping the wheel face and diamond cool, smothering dangerous and damaging dust and preventing excessive diamond wear or possible damage to the stone from overheating.

NORTON and

COMPLETE INFORMATION SAVES PRODUCTION HOURS

Our Order No.
RW - 41 - 30408 - 32

Ship by TRUCK

Quantity	Material	Part No.
1	Feed Control Cylinder	68987
1	Feed Control Cylinder Key	72133
2	Dash Pot Pistons	69008
1	Adjusting Nut	71812
2	Springs	72331

For
Norton 10 x 36" Type C Semi Automatic grinder
Serial No. 12416 - 1937

The serial numbers on some Norton Grinders will be found on the front edge of the sliding table.

EXAGGERATED? Not a bit of it! Daily we get many similar letters to that shown on the left page. Too seldom is full information available as above.

Styles in feed screws have changed in the past 40 years; hence a request for a "feed screw for an external grinder" is meaningless.

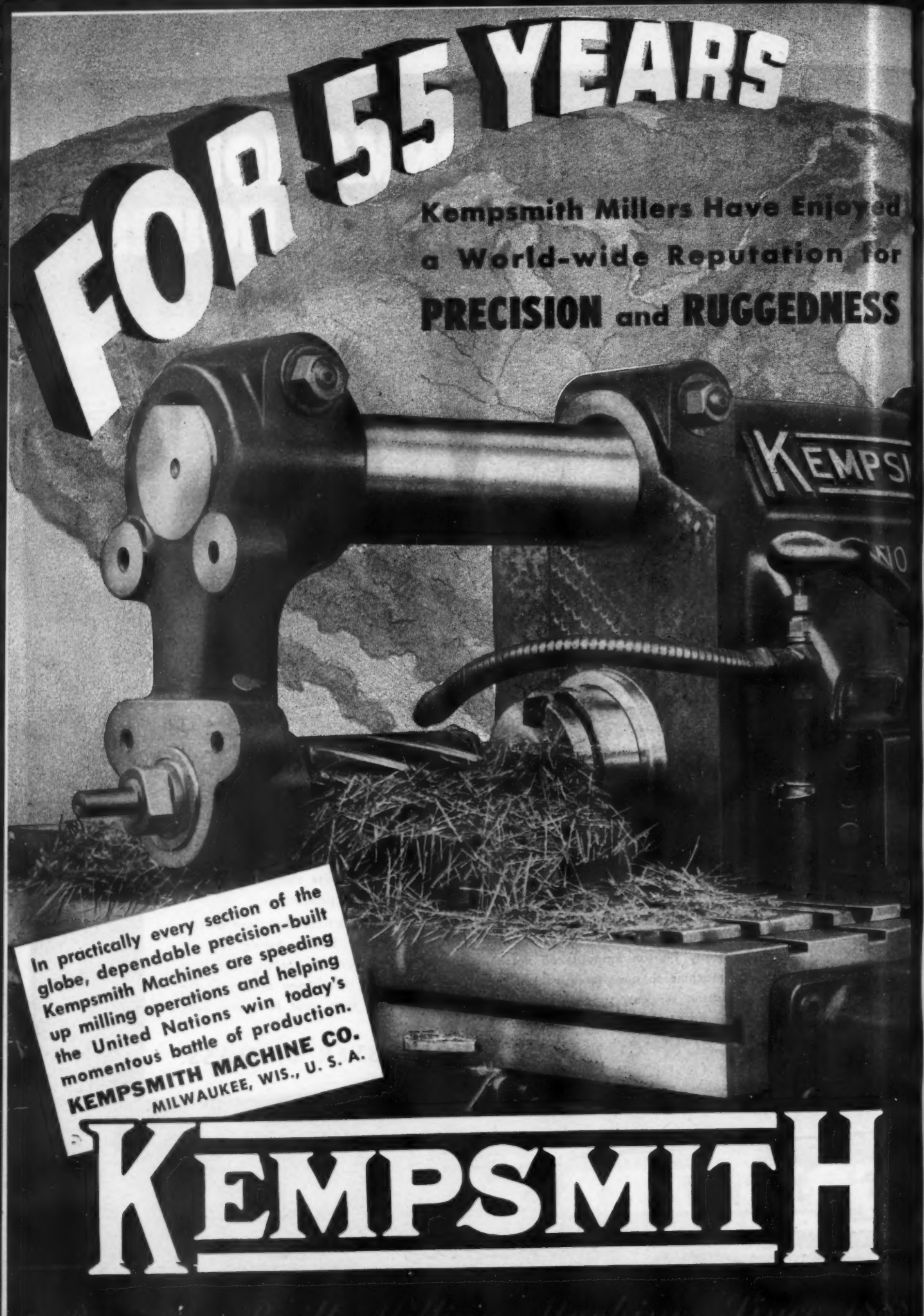
It takes time to hunt down obscure parts from such indefinite clues. Correspondence to clear up the mystery wastes still more time, stalls your production.

So — if you want prompt action when ordering a vital part for that "out of production" grinder; following up an order scheduled on our books; asking for one of the many Norton manuals on machine operation and service; seeking a certain Norton machine to turn out top-flight production; or taking advantage of any of the many Norton services, supply FULL INFORMATION. It will save your time and ours; time best devoted to War Production.

NORTON COMPANY, WORCESTER 6, MASS.

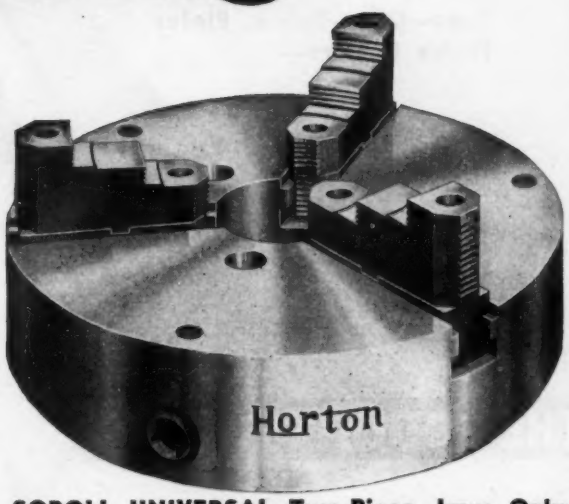
M-466

GRINDERS
Lappers


FOR 55 YEARS
Kempsmith Millers Have Enjoyed a World-wide Reputation for PRECISION and RUGGEDNESS
In practically every section of the globe, dependable precision-built Kempsmith Machines are speeding up milling operations and helping the United Nations win today's momentous battle of production.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

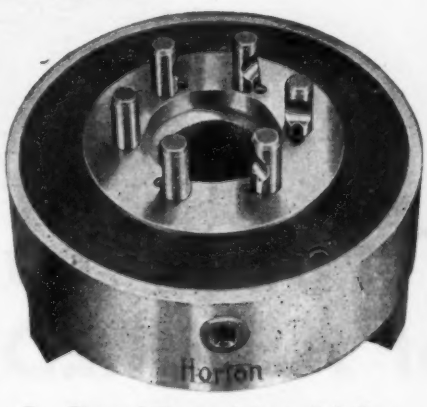


SCROLL UNIVERSAL Two-Piece Jaws Only

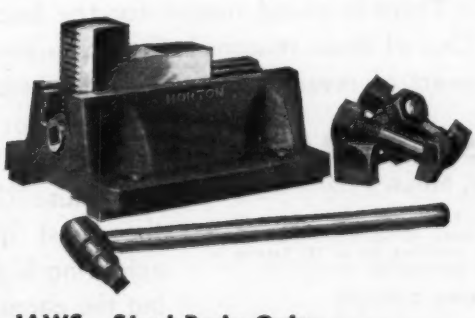
For Use With Intermediate Plates On Threaded Spindles

For Key Drive Tapered Nose Spindles

War Production Limited To These Essential Chucks



For Flanged Tapered Nose Spindles
Illustration shows Chuck for Type D (Cam Lock) Spindle



FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON
MORROW

SINCE 1851 .... THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws—End Mills—Taps—Dies—Screw Plates Profile Cutters—
THE TOOLS YOU BUY AGAIN

Try them on the basis of ASSURED *better performance . . .*

Shop after shop has come to recognize the ruggedness, accuracy and fast cutting action of UNION TOOLS after proving them out on difficult jobs.

There is sound reason for the better performance of these cost cutting tools. One of these reasons is the *experience behind them*—an experience that involves years of research, as well as outstanding technical, metallurgical and manufacturing facilities second to none in the field of small tool production.

Because Union has the means for producing tools of the finest quality and concentrates every resource on achieving highest performance standards on all tools bearing the name "UNION", users of UNION tools can always be certain of efficient, economical service.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION

If Nazis were penguins...

IMAGINE ARMIES of penguins goose-stepping all over the South Pole! Heil, Pengler!

But penguins aren't birds of prey. They're just simple fishermen. They'd never yearn for other people's territory. Even if they enjoyed goose-stepping, they'd confine their marching to the Antarctic.

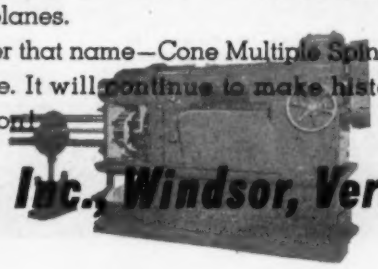
Suppose the situation were reversed. What if penguins were Nazis? They'd certainly become dissatisfied with the South Pole. They'd start "protecting" their neighbors. And after a few peace overtures, they'd attempt a Polar blitzkrieg!

The moral? Just this: You can't make a plunderer out of a penguin, and you can't make a nobleman out of a Nazi. So long as there are Nazis in the world, men cannot be sure of being free.

That's why we must war to the death against the Nazis. In doing so, we must lean heavily on our machine tool industry. We can lean with confidence. This miracle-making industry has overcome Germany's 7-year head start in about a year. And today, for every one machine tool produced by the Nazis, **we are producing 5!**

A potent factor in this production miracle has been the Multiple Spindle Automatic Lathe made by Cone. These production titans of the machine tool industry are currently used in the production of parts for guns, tanks and planes.

Remember that name—Cone Multiple Spindle Automatic Lathe. It will continue to make history after victory is won!



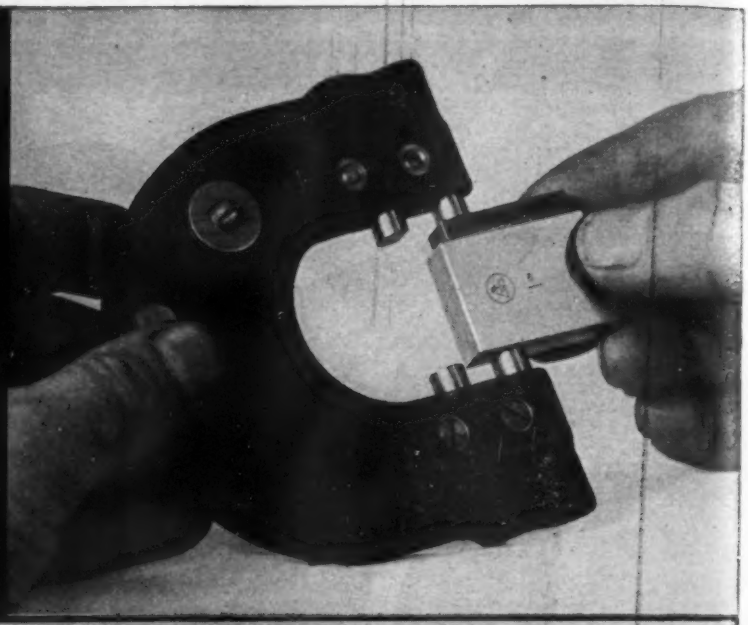
CONE Automatic Machine Company, Inc., Windsor, Vermont

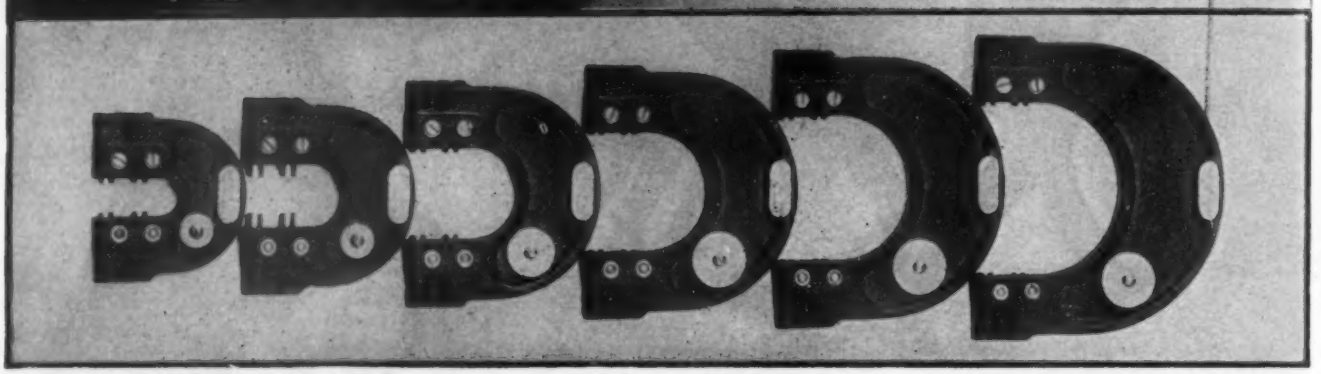
YOUR
PRODUCTION INSPECTION
CAN BE SPEEDED
WITH

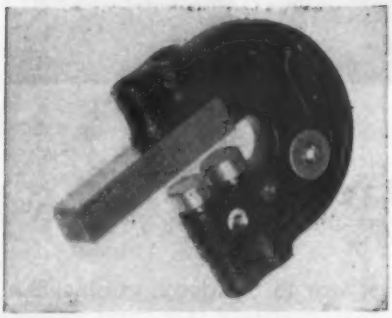
ATLANTIC

ADJUSTABLE LIMIT

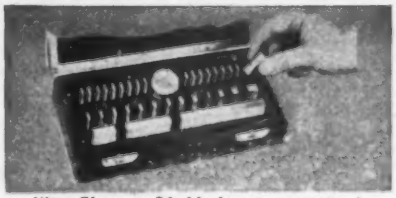
SNAP GAGE SETS







OTHER INSTRUMENTS
IN THE SCHERR
LIMITED BUDGET
INSPECTION LABORATORY



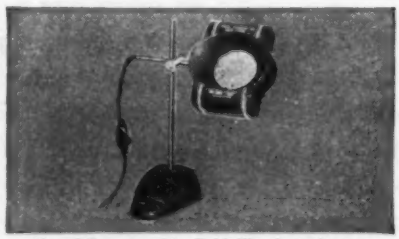
Ultra-Chex—a 34 block set accurate to .000008" and providing a basic standard of measurements.

. . . SIZE RANGE FROM 0 to 6"

These sets provide the means for instant inspection with a minimum dependence on operator's skill. Even the novice (man or woman) can quickly become proficient in inspecting machined, turned or ground work. With these sets, all parts from the smallest size up to 6" diameter can be checked by the fast and accurate "go" and "no go" method. With several sets available, it is possible to select the one that comes within the range of your specific work.

An important feature of the "ATLANTIC" is the use of Meehanite frames to assure utmost rigidity and maintain the original form and shape of the frames. Long-lived accuracy, even in hard continuous service, can be depended on as a result of using this special metal in construction.

ATLANTIC ADJUSTABLE SNAP GAGES can be furnished with a wide range of special anvils for special work. Outline your requirements for quotation.



Magni-Ray—a wide field illuminated magnifier for close inspection of work and operations.

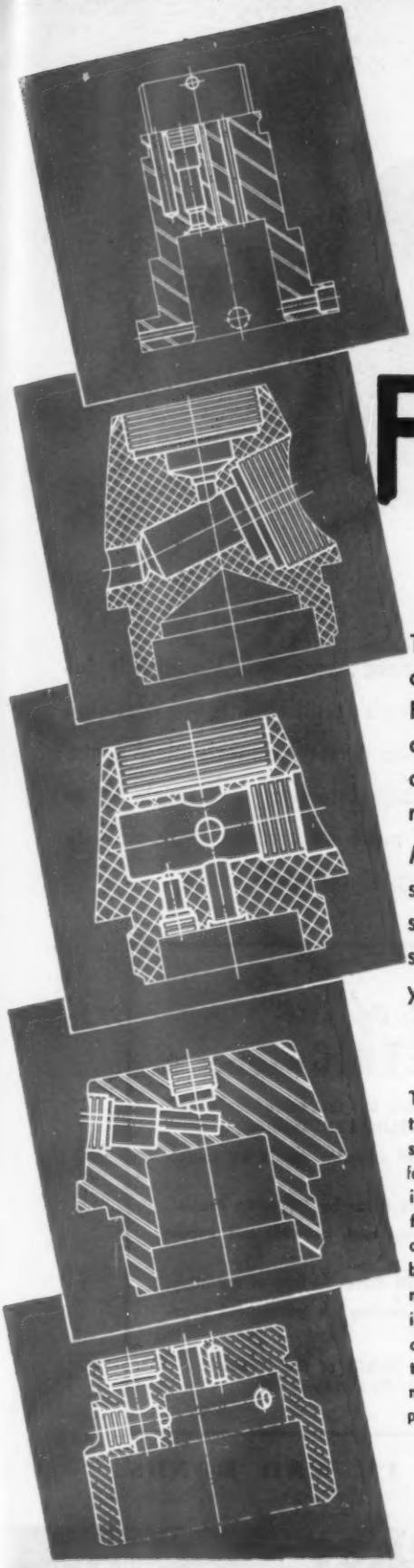
The Following Sets Are Available For Prompt Delivery

PRODUCTION SET No. 1—6 gages Model A—range 0 to 3"	$34.83
PRODUCTION SET No. 2—10 gages Model A—range 0 to 6"	66.15
PRODUCTION SET No. 3—12 gages Model C—range 0 to 3 1/16"	82.51
PRODUCTION SET No. 4—19 gages Model C—range 0 to 5 11/16"	146.77

●

Specify production set required by number when ordering. All prices are net F.O.B. factory; gages are unset to size and unsealed. Kindly give complete priority information to expedite shipment. Further details on request.

GEORGE SCHERR COMPANY, INC.
124 LAFAYETTE STREET • NEW YORK, N.Y.



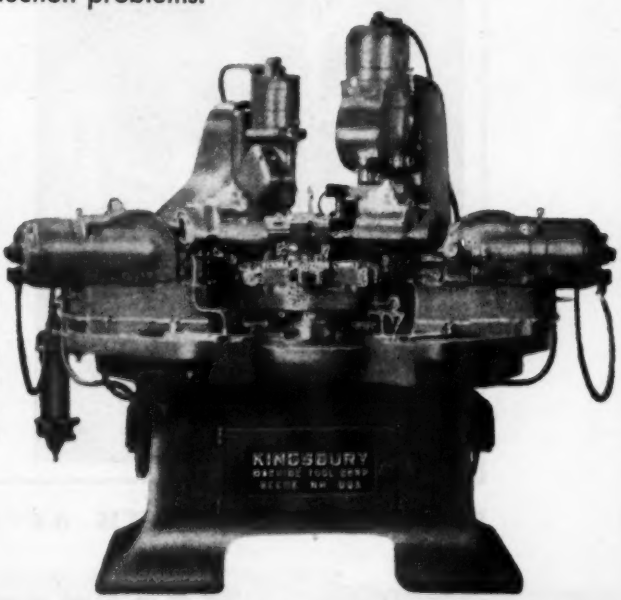
Intricate Fuse Parts Produced with Minimum Number of Chuckings

FLEXIMATIC
by KINGSBURY

The blanks for these shell fuse parts are taken from automatics and completed in from one to four handlings. Kingsbury FLEXIMATICS make it possible to perform in a single chucking a dozen or more highly intricate machining operations on fuse and rifle components and similar parts where speed and accuracy are essential to successful National Defense production.

Munitions production presents a three-fold problem . . . high standards of accuracy, pressing production demands and scarcity of skilled labor. Kingsbury FLEXIMATICS provide—in a single machine—the efficient means to solve all three phases of your defense production problems.

The FLEXIMATIC system of construction consist of Standard Units for drilling, tapping, boring, reaming, spotfacing, etc. Mounted on one of several standard bases. This unique method provides a flexible set-up which can be changed over to meet the machining requirements of many different parts.

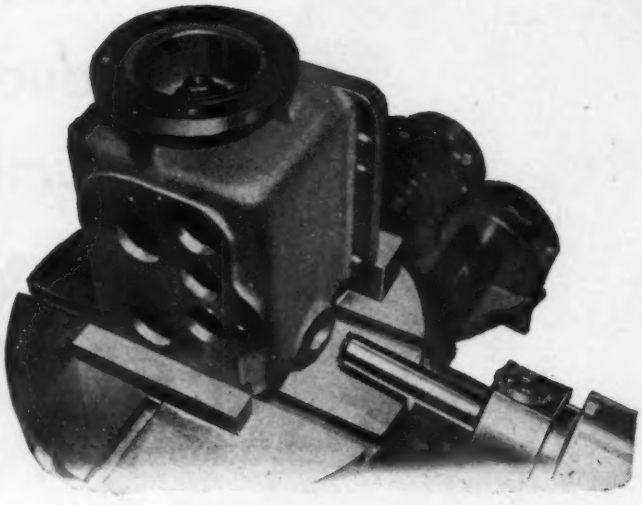


KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

THIS JOB CAN BE BORED IN A *Single* SETUP

IT'S NO TRICK WITH THE AUTOMETRIC MODEL B



This interesting boring job requires a minimum of setup time on the Autometric. Holes on all four sides of the gear case were accurately bored in relation to the large vertical bore — in one complete setup. Note that the hole is on a 15° angle.

The many-purpose Autometric Model B is designed for *today's* requirements — precision boring of a wide variety of mechanical parts. It handles a complete job in a single setup — faster and more accurately. Its simplicity makes training of operators easy.

Features of the AUTOMETRIC MODEL B

- Errorless measuring by the more rapid and more accurate AUTOMETRIC Method.
- Infinite variation of spindle speeds by finger-tip control.
- Infinite selection of feeds by finger-tip control.
- Steel Ways — hardened, ground, and super-finished.
- Spindle direct V-Belt driven — free of vibration.
- Well-ribbed body casting for permanent alignment and rigidity.

Write for full details of the Model B Autometric Jig-Boring Machine

BUY VICTORY WITH AT LEAST 10% IN WAR BONDS

Rotary Head Milling Machine
•
Autometric Jig Borers
•
Center Scope

Kearney & Trecker *Products*
CORPORATION
Milwaukee, Wisconsin
Subsidiary of Kearney & Trecker Corporation

Milwaukee Face Mill Grinder
•
Milwaukee Midgetmill
•
Milwaukee Speedmill

New Facts on Metal Cutting

THE PICTURE ABOVE is a photographic enlargement of the cross-section of a tool cutting metal. NOTICE THE BUILT-UP EDGE. That small piece of metal alternately builds up and sloughs off. It is the key to tool life and work finish.

The built-up edge, during its existence on the cutting edge, exerts the pressure which does the actual cutting or shearing of the metal.

Sufficient build-up protects the cutting edge by localizing the rubbing action of the chip some distance from the cutting edge.

Excessive build-up is squeezed between the tool and the work and spoils the finish. *Adequate mobility* prevents this, and enables the built-up edge to slough off with the chip.

The "anti-weld" property of the cutting fluid controls the size and mobility of the built-up edge!

In the laboratory and in practice Socony-Vacuum technicians have isolated and studied many other factors necessary in a cutting fluid.

THIS IS NEW, IMPORTANT INFORMATION. It may be able to vitally improve your rate of production!

GARGOYLE Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

SUGGESTIONS TO INCREASE PRODUCTION

RIVETT

104 INT.-EXT. GRINDER

For Small Hole, Cylindrical and Concentric Grinding

The Rivett No. 104 is a simple, accurate grinder suitable for die and tool making as well as precision manufacturing. Its ease of setting and operation, and its selective spindles make it an efficient machine for internal and external grinding. The internal or external grinding spindle bracket may be selectively mounted on cross slide as desired. For [illegible] work requiring concentric grinding of internal and external [illegible] at one chucking, turret carrying both internal and [illegible] may be used.

Work may be held in collet, step chuck, jaw chuck or fixture or on centers when using external [illegible]. Table reciprocation has three speeds from 54 to 126 passes per minute. Length of table travel is infinitely adjustable between ¼" and 2" or ½" and 4" depending on range selected.

External Spindle and Tailstock

Internal and External Spindles in Turret

SPECIFICATIONS

Grinding cap., hole dia.	up to 3"
Grinding cap., outside dia.	up to 3"
Automatic table travel	
Standard	¼" to 2"
Special	½" to 4"
Hand table travel	11"
Swing over table	8"
Center distance	8"
Workhead swivel	90°
Table swivel	5°
Cross feed graduations	
Standard	.0005"
Special	.0001"
Travel of cross slide	1¾"
Collet capacity	⅞"
Step chuck capacity	6"
Jaw chuck capacity	6"
Workhead spindle speeds	200, 375, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	21000 and 25000 r.p.m.
External	3800 r.p.m.
Net weight with motors	1750 lbs.

For Further Description
Write for Bulletin 104

RIVETT LATHE & GRINDER INC.

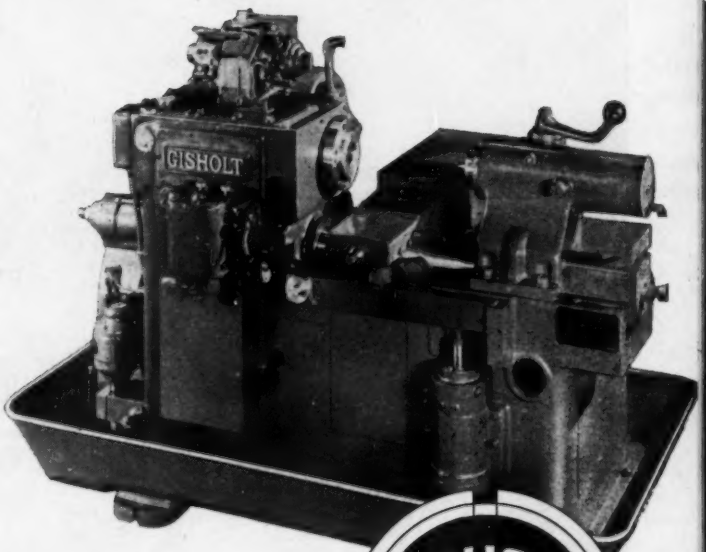
BRIGHTON, BOSTON, MASS.

TOO MUCH, TOO SOON

FOR THE AXIS!

In only four short years, the American machine tool industry has built more tools than were produced in the previous forty. They're better tools, faster, more accurate, easier to operate.

Today, they're all working in essential war industries. They're winning the battle of machines against machines. You may be confident that they're helping America create an irresistible striking power that our enemies will never match.



GISHOLT MACHINE COMPANY
1201 East Washington Avenue • Madison, Wisconsin

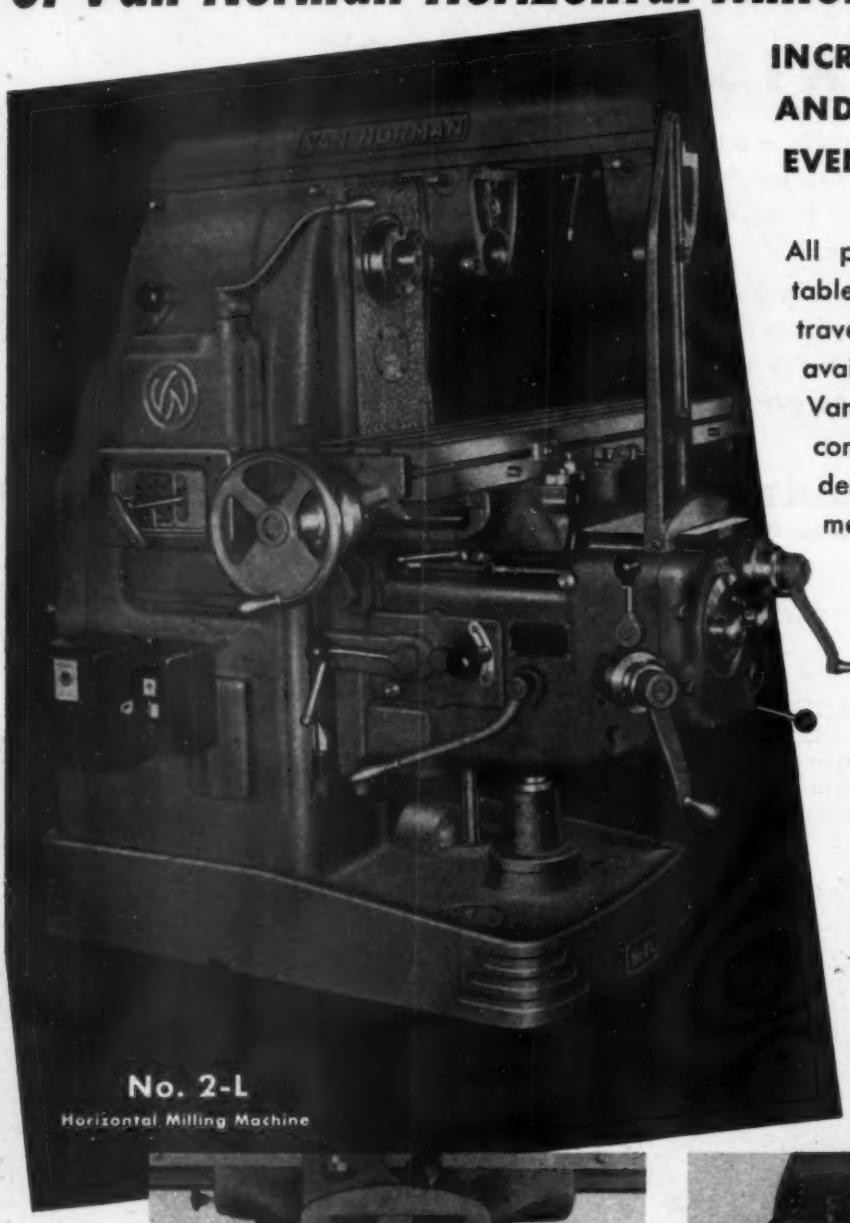
Look Ahead . . . Keep Ahead . . .
With Gisholt Improvements in Metal Turning

GISHOLT

THE GISHOLT AUTOMATIC HYDRAULIC LATHE requires so little attention that one man (or woman) can tend two or three machines. Easy tool set-up and adaptability to handle a variety of work, make it practical to use its high machining speeds even in small lot production.

TURRET LATHES · AUTOMATIC LATHES · BALANCING MACHINES

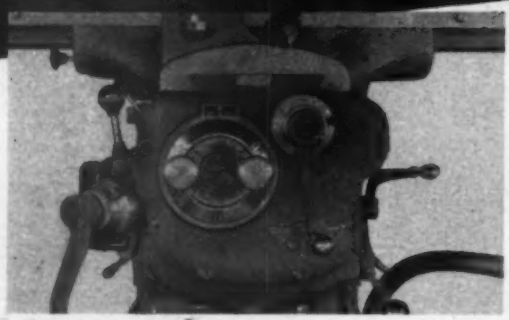
CONTROL of Power Feeds from Front and Rear of Van Norman Horizontal Millers . . .



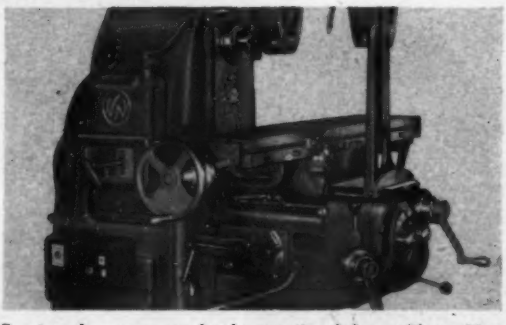
No. 2-L
Horizontal Milling Machine

INCREASES WORK ACCURACY AND SPEEDS PRODUCTION — EVEN WITH NEW OPERATORS

All power feed controls for saddle, table, knee . . . as well as 6-way rapid traverse . . . are instantly and readily available from the front or rear of Van Norman Horizontal Millers. These controls operate in the direction of desired table, saddle, or knee movement, thus the operator *always* knows that each unit will move in the same direction that the lever is pushed. Add to this, such control features as single lever speed selector, quick change feed selector, easy to reach spindle lever, large readable dials and it is easily seen how ease of control enables experienced operators, as well as beginners, to mill more work faster with greater accuracy and less spoilage.



Showing sturdy, well proportioned 2-L Van Norman knee and generous saddle support surfaces for table, as well as convenient location of operating controls.



Front and rear power feed operating levers with positive directional control; fast selection of speeds; convenient spindle reverse; adjustable spindle clutch lever.

ARMY E NAVY

VAN NORMAN COMPANY

Springfield, Massachusetts

CAPACITY . . . SPEED . . .
and ACCURACY . . .

Fosdick Radials

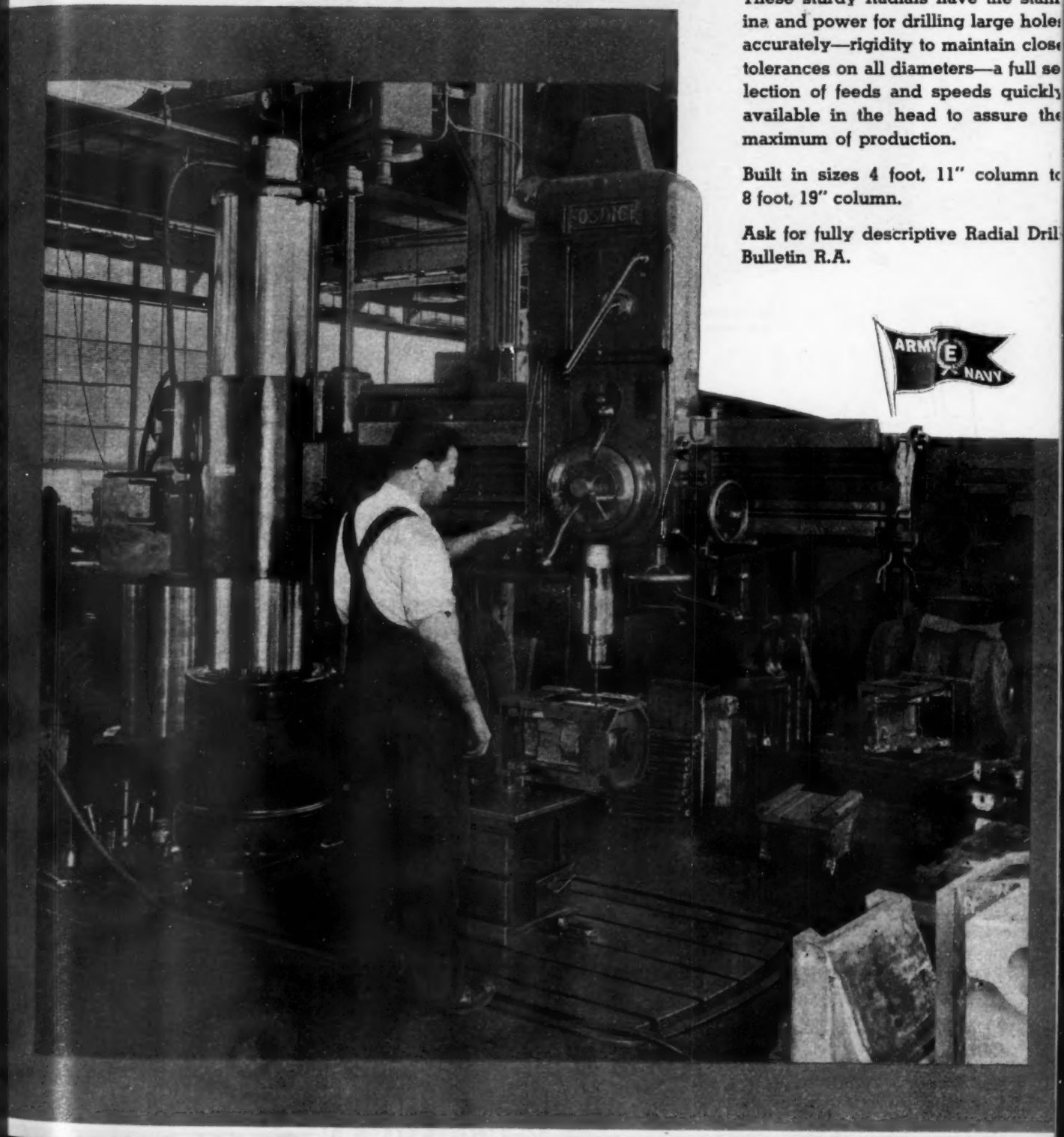
● As our army gains new objectives on our scattered war fronts there is still greater need for vital equipment arms and ammunition.

Fosdick Radials in hundreds of shops are working long hours day after day to produce the utmost of vital equipment for our fighting forces.

These sturdy Radials have the stamina and power for drilling large holes accurately—rigidity to maintain close tolerances on all diameters—a full selection of feeds and speeds quickly available in the head to assure the maximum of production.

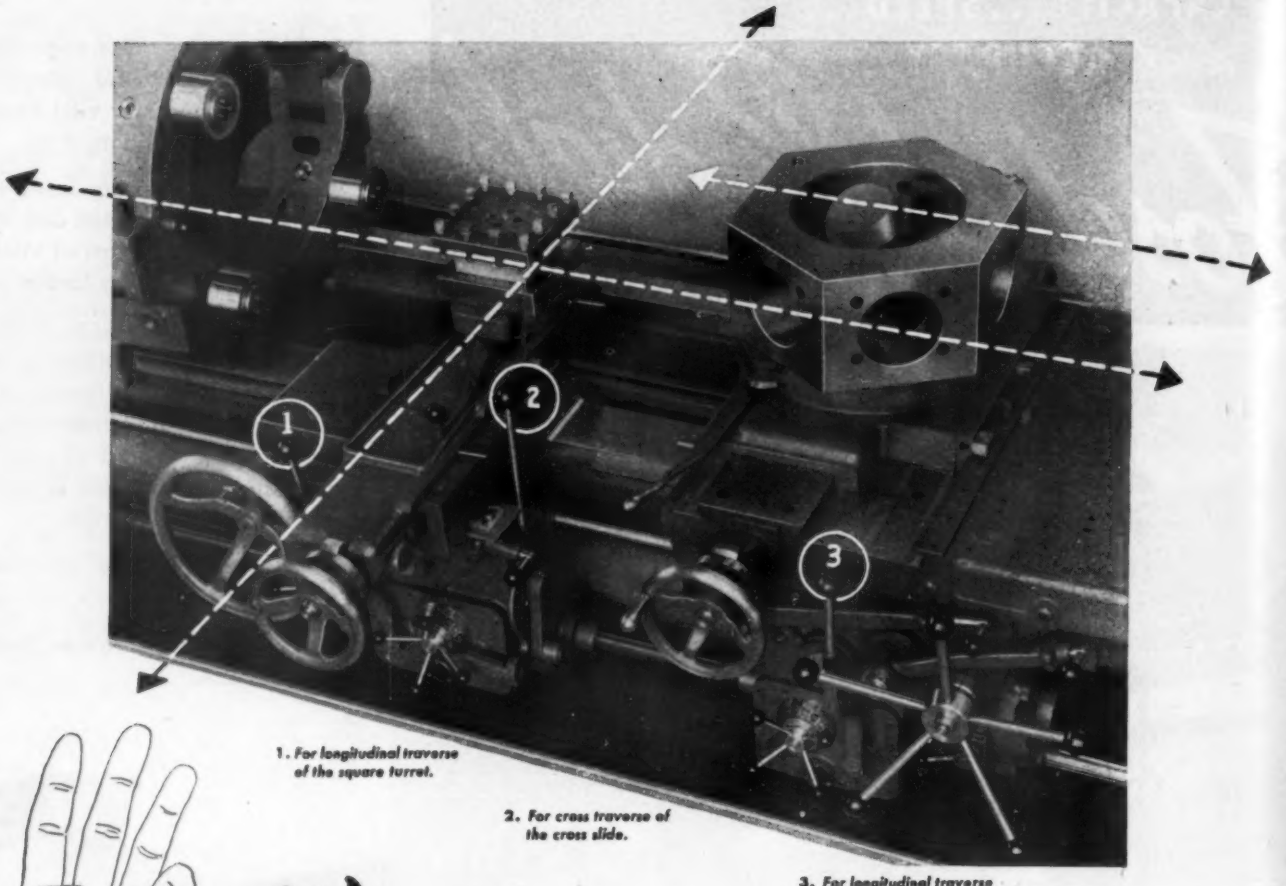
Built in sizes 4 foot, 11" column to 8 foot, 19" column.

Ask for fully descriptive Radial Drill Bulletin R.A.



FOSDICK MACHINE TOOL COMPANY
CINCINNATI . . . OHIO

AN EXCLUSIVE GISHOLT ADVANTAGE



1. For longitudinal traverse of the square turret.

2. For cross traverse of the cross slide.

3. For longitudinal traverse of the hexagon turret.

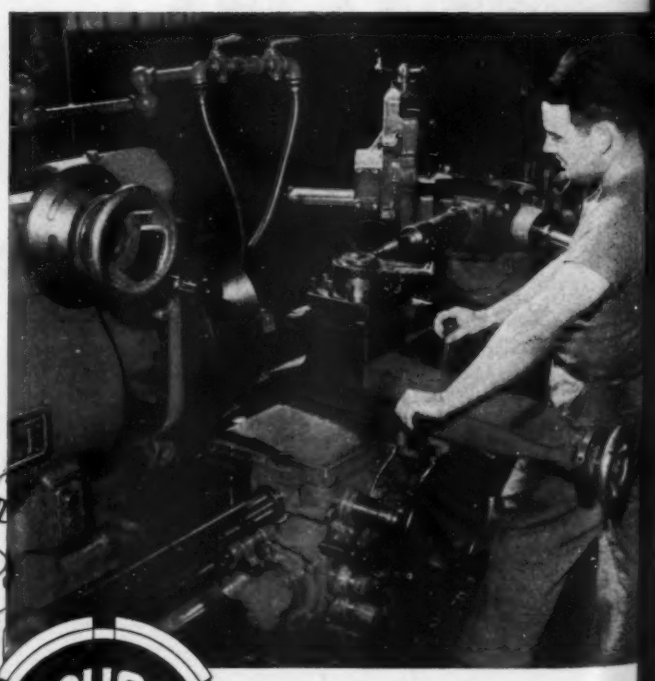
"3 Way" POWER RAPID TRAVERSE

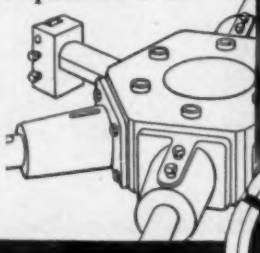
...aid to war production

There's no half measure about Gisholt's Power Rapid Traverse, provided not only for the longitudinal travel of *both* the square and hexagon turret carriages, but also for the in and out movement of the cross slide. These traverses, standard on Gisholts, bring the tools more quickly into position preliminary to actual cutting operations. They may be operated simultaneously or independently in either direction.

This quicker positioning of cutting tools reduces time between cuts, and conserves the operator's energy for productive work. The potent influence on the day's production of these aids to easy operation is readily appreciated by observing the frequency, ease and safety with which they are used by operators.

Gisholt's *complete* Power Rapid Traverse is but one of many features which speed-up turret lathe operation to increase war production now—and to cut costs afterward.





GISHOLT MACHINE COMPANY
1201 E. Washington Ave., Madison, Wis.

Look Ahead . . . Keep Ahead . . . With Gisholt Improvements in Metal Turning

TURRET LATHES • AUTOMATIC LATHES GISHOLT **BALANCING MACHINES**

Van Keuren

OPTICAL FLATS

THE PROOF OF PRECISION IN AMERICAN INDUSTRY SINCE 1920 . . .

How do you check the accuracy of your precision gage blocks?

How do you maintain accuracy on your measuring equipment?

How do you test the flatness of precision lapped parts?

The Van Keuren Light Wave Measuring Equipment illustrated above measures millionths of an inch, and is a fundamental requirement in plants where precision is maintained. The equipment consists of three semi-quartz master flats, one steel flat and a monochromatic light. The monochromatic light shows clear and distinct light wave bands which have a known measuring value of 11.6 millionths per dark band. Straight bands indicate a flat surface and curved bands show a convex or a concave surface. Be sure to specify Van Keuren Light Wave Measuring Equipment with complete instructions for your inspection work.

Van Keuren optical flats are the ultimate in precision. Single flats and optical parallels are available in 1¼", 2", 3", 4" and 6" diameters in both master and working grades. Special flats are made on order. Optical flats are easy to use. Complete instructions on "How to Use Light Waves" are furnished with all Van Keuren optical flats.

Detecting a Worn Spot on an Amplifying Gage Anvil

The light wave interference bands dip an amount equal to twice the distance between adjacent bands, showing a valley 2 bands (or 23 millionths) deep.

The Van Keuren Manual of Precision Measuring Tools gives complete specifications and prices on optical flats. Write for your copy.

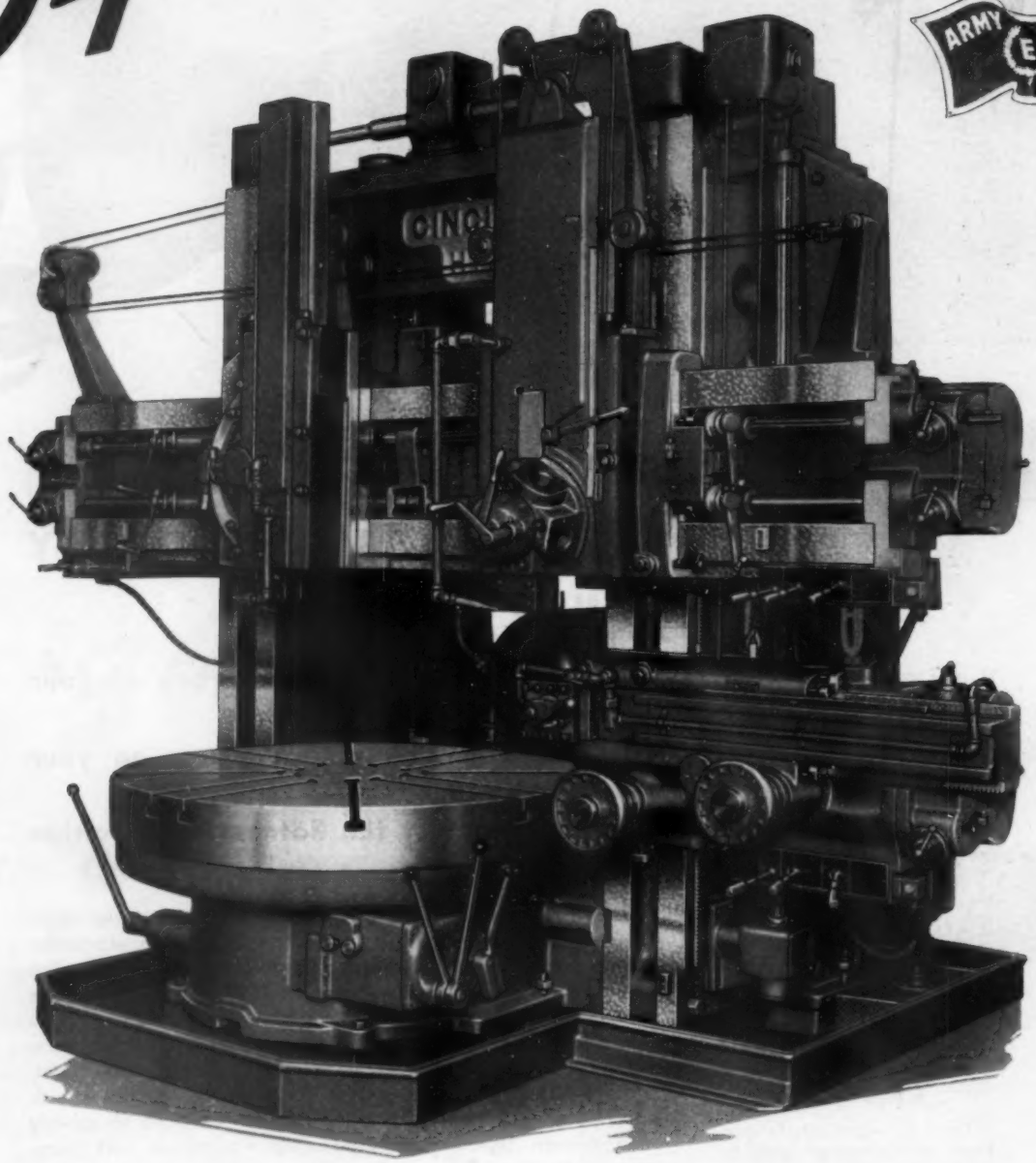
Van Keuren

24th YEAR

THE Van Keuren CO., 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles

CINCINNATI 64" VERTICAL BORING MILL Hypro



The Cincinnati Hypro 64" Vertical Boring Mill can be furnished with Six Head combinations:

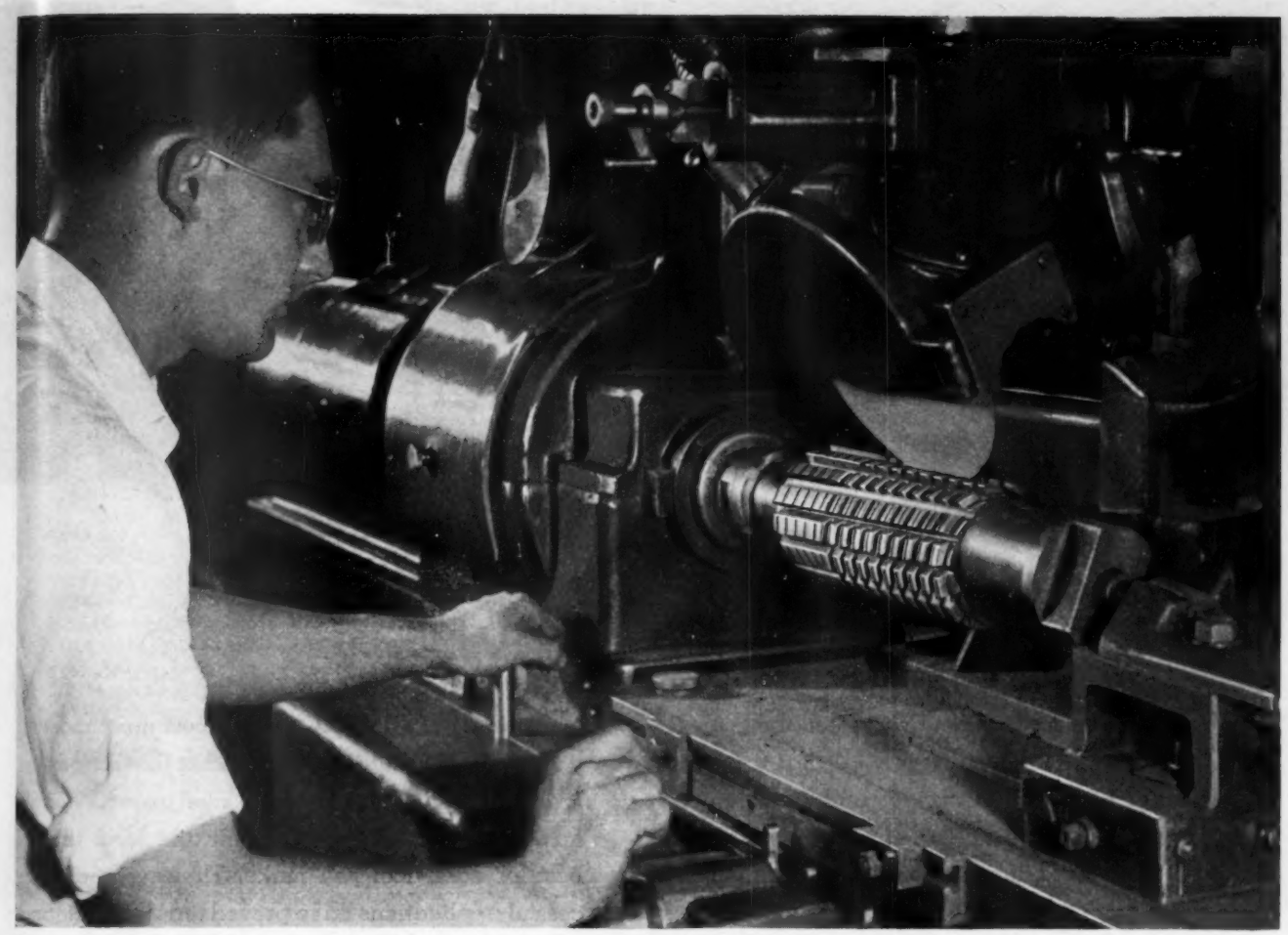
- Two Ram Heads
- Ram and Turret Head
- Ram, Turret and Side Head
- Two Ram Heads and Side Head
- Ram Head and Side Head
- Turret Head and Side Head

Get acquainted *now* with the exclusive Hypro (High production) features found only in a Cincinnati Hypro Vertical Boring Mill. Shipment 2 weeks. Write for descriptive bulletin #130A.

THE CINCINNATI PLANER COMPANY

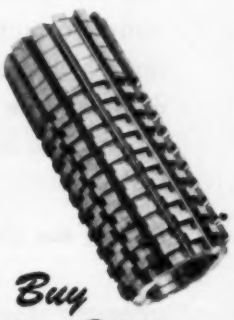
Planers...Vertical Boring Mills...Planer Type Millers

CINCINNATI . OHIO . U.S.A.



EXAMPLE OF ACCURACY...CLOSE LIMITS HELD ON BARBER-COLMAN NO. 4 HOB SHARPENING MACHINE

BREECH rings on certain important U. S. field guns are threaded with Barber-Colman Ground Thread Milling Cutters. One of these is shown here being sharpened on a B-C No. 4 Automatic Sharpening Machine. This description concerns not only the accuracy of this cutter, but the ability of the machine to maintain that accuracy on a cutter of such size (4½″ O.D. by 10.875″ long). For instance, the spiral gash has a lead of 300.00″, which must be held within .001″ on the length of the cutter. The parallelism of the cutter is held within .0006″. A deviation of lead or angle of gash will produce a taper condition which will change the form. The index error is held within .0005″ tooth-to-tooth and .001″ cumulative. The teeth have a rake of 7½° which must be held within ± 0°5 minutes. The pitch from tooth-to-tooth is within ± .0002″ and ± .002″ cumulative per foot, this being an indication of the accuracy held in the manufacture of this Ground Cutter. Also, the limit on tooth depth is ± .00025″ and on the O. D. runout is .0005″. By repeating a previously determined machine set-up each time, the B-C No. 4 Automatic Hob and Formed Cutter Sharpening Machine will consistently duplicate such precision accuracy as described here. For further information and application to your sharpening problems, write for Bulletin F 1011-2.



Buy War Bonds

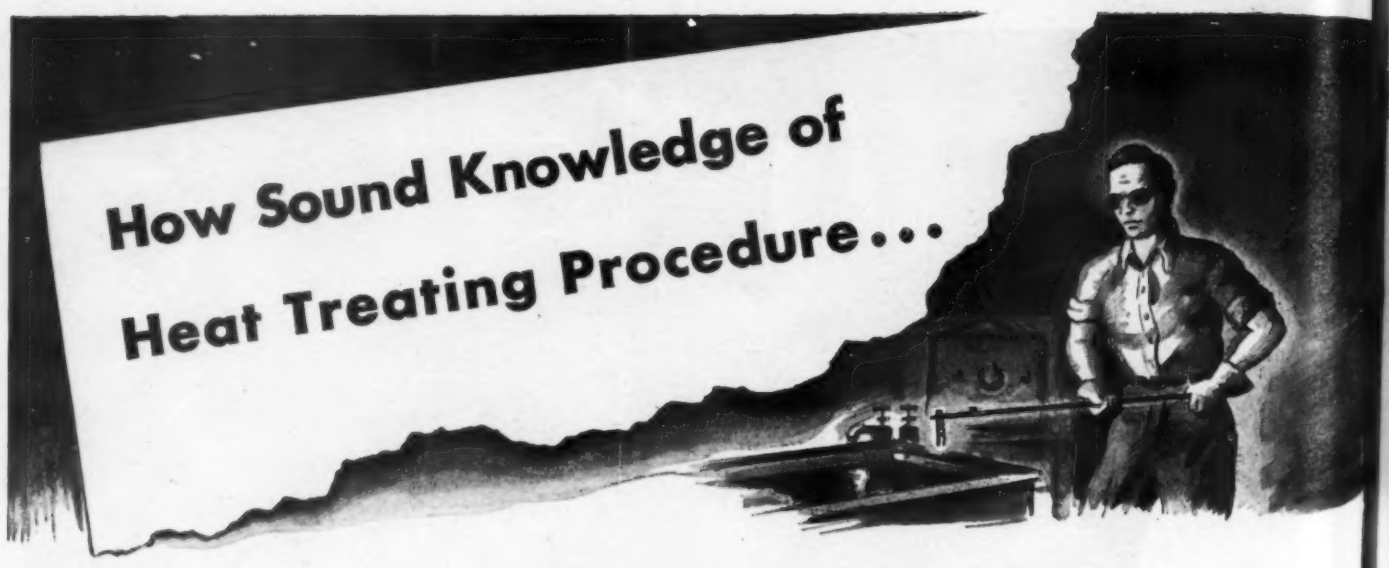
CUTTING TOOLS ARE SCARCE
MACHINES CAN'T RUN WITHOUT THEM
CONSERVE WHAT YOU HAVE

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

Barber-Colman Company

GENERAL OFFICES AND PLANT • 201 LOOMIS STREET • ROCKFORD, ILLINOIS, U. S. A.

How Sound Knowledge of Heat Treating Procedure...



helps you avoid tool troubles that interfere with War Production

Today, with practically every tool room on 24-hour-a-day production, it is vital that tools come through heat treating intact and free from any condition that might affect the performance of the tool. Every die that lets go, every tool that is improperly hardened not only means a loss of many hours of skilled work, but is a threat to production schedules.

Getting hardening results that assure the kind of tools that give longer uninterrupted production is largely a matter of two things. First, having the right steel. Second, having complete heat treating data. And on each of these points, Carpenter is prepared to help you make the most of your tool making hours.

Among the nine Carpenter Matched Tool Steels, you are sure to find the steel to best meet most of your tool room requirements. And in the Carpenter Matched Set Method of tool steel selection you have a system for selecting the *one* steel that is best for each tool you make. Thousands of successful applications have proved that the Matched Set Method definitely helps to get more productive time from tools and machines.

For help in heat treating the Carpenter Matched Tool Steels, your nearby Carpenter representative will be glad to give you the benefit of his long practical experience. He can render on-the-spot service—keep you in touch with our Metallurgical Department—and supply you with literature packed with helpful information, such as that on the opposite page.

For "Refreshing" Skilled Tool Makers and Training New Men. More than 43,000 copies of this text book are now in use. Copies are available to tool steel users in the U. S. A. at cost, $1.00—$3.50 elsewhere.

For Tool Room Foremen and Tool Hardeners. A 167-page manual with a comprehensive explanation of the Matched Set Method of Tool Steel Selection, detailed heat treating data and hardening instructions. Free to tool steel users in the U. S. A.

The Four Fundamental Laws of Quenching

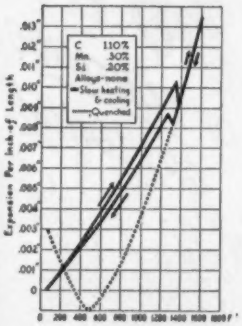
Quenching is one of the most important—and perhaps least understood steps in the heat treating operation. Anyone who has ever seen a piece of hot tool steel disappear into a quenching tank, and come out cold a few seconds later can appreciate how difficult an operation it is to study. However, when he further considers that it is at this stage that the steel hardens—and further, that warpage, size change, cracking, internal strains and soft spots are all dangers of improper quenching, he gains some idea of its importance.

There are possibilities in the quench tank that the hardener does not always realize. It is common knowledge that quenching produces *internal strains* in a piece of steel—forces that are sometimes powerful enough to smash a piece of hardened steel whose strength may measure close to 400,000 lbs. per sq. in. If forces of this magnitude can be developed in quenching, it is worthwhile to devote some effort to making them *useful* instead of destructive. Here are the four fundamental laws of quenching:

LAW NO. 1—*Steel is stronger cold than hot.* Everyone knows that steel is easier to bend, shape or deform when it is hot. Therefore, when hot steel comes into conflict with cold steel, the cold steel always wins. *(This law explains why a steel rod quenched horizontally will warp upward at the ends.)*

LAW NO. 2—*Steel expands when heated and contracts when cooled.* This is illustrated by the solid curve in the chart, which shows the behavior of a piece of high carbon tool steel heated and cooled slowly in a furnace. Starting at room temperature, the steel gradually expands up to about 1350°F. when it will be about .010" longer per inch than it was when it started. Here, it reaches the critical point, and while going through the critical, it shrinks somewhat. Above the critical, it continues to expand at a more rapid rate.

On cooling slowly, it shrinks until it reaches about 1310°F. expands while going through the critical and then shrinks back to its original size as room temperature is reached. *(The importance of this law is obvious—since, if different parts of a tool are not cooling at the same rate, stresses will be set up in proportion to the difference in cooling rates.)*



LAW NO. 3—*Some tool steels increase in volume when hardened.* This is particularly true of water-hardening tool steels. They actually increase in size all over—just as water expands when it freezes. The dotted line in the chart shows the approximate course through which carbon tool steel would travel if it were quenched instead of being cooled slowly. It would continue to shrink (without any critical point interruption) to some temperature in the neighborhood of 500°F. As it cooled below this temperature, it would expand until it would finally be about .003" per inch longer than it was when it started in the annealed condition. *(This law explains why some tools change size in hardening and why some break in the quenching bath. Size change as such is not necessarily disastrous, but if the volume change in part of the tool differs greatly from that in an adjacent part, cracking may result.)*

LAW NO. 4—*All steels when stressed under the elastic limit have the same elastic properties—regardless of composition or heat treatment.* This may seem impossible, but it is true nevertheless and has been demonstrated many times. All steel, *regardless of its analysis or heat treatment* will stretch exactly .001" per inch under a load of 30,000 lbs. per sq. in. *(This law makes possible the measurement of internal stresses in a piece of quenched tool steel, by simply measuring the amount of distortion. By such a study it is possible to obtain information to control the quenching operation so as to minimize warpage and breakage.)*

Much helpful information on quenching, like that above, is contained in "Tool Steel Simplified". It is only a small part of the hundreds of pages of practical information on every phase of tool making given in the book. You can put *all* its useful facts to work in your tool room by making copies available to your tool room men. "Tool Steel Simplified" is available *at cost*—$1.00—in the U. S. A.

The Carpenter Steel Company, 109 Bern Street, Reading, Pa.

Carpenter MATCHED TOOL STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

THAT'S THE RECORD SET BY A
MID-WEST "B" BOND GRINDING WHEEL
OF THE TYPE PICTURED HERE

The "38 hour" wheel is a MID-WEST "B" BOND WHEEL, Type 5, 7.80, JB5, sized 10 x 2 x 2 and recessed on one side. It was installed on an Ex-Cell-O dry grinder by a large munitions plant in New Jersey and was being used to sharpen cemented carbide tool tips.

In a report submitted to the MID-WEST ABRASIVE COMPANY, engineers of the New Jersey plant said:

"This wheel lasted for 38 hours of continuous grinding. Best wheel ever used on this job. The wheel held its shape and required considerably less dressing."

For faster, more efficient carbide tool grinding order MID-WEST "B" Bond wheels today!

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT 11, MICH.

Increased Production from Lathes Built to Produce

SIDNEY

SIDNEY LATHES

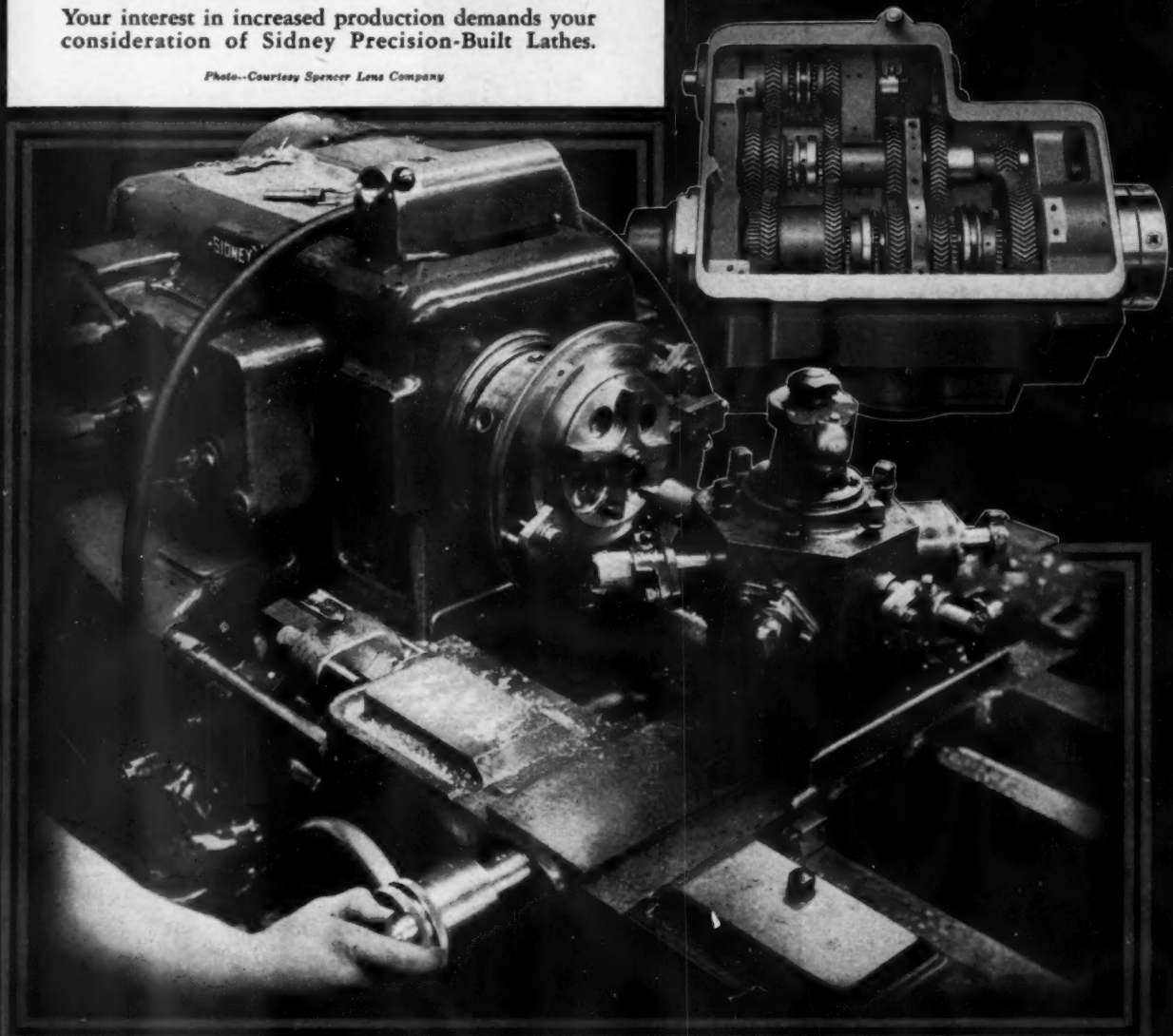
with Continuous Herringbone Geared Head

● The Sidney Continuous Tooth Herringbone Geared Head is not only distinctive in design but is based on sound engineering principles. The Headstock, while only one of the component units of the lathe, is the unit that merits the purchaser's most serious consideration.

Illustration shows the exclusive Sidney Headstock transmission, providing 16 selective spindle speed changes, with all the gears in constant engagement, and speed changes secured by means of sliding clutches of the internal and external involute tooth type operating on multiple spline shafts. Precision, rigidity and stamina are built right into this unit resulting in a smooth flow of power, finished work free of tooth marks, minimum of maintenance attention and a definite increase in production.

Your interest in increased production demands your consideration of Sidney Precision-Built Lathes.

Photo—Courtesy Spencer Lens Company



The **SIDNEY MACHINE TOOL** *Company*

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 **OHIO**

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ **Production**

Adaptability

Fixture Saving

Operation Saving

Material Saving

★ **Fine Finish**

★ **Flatness**

Close Limits

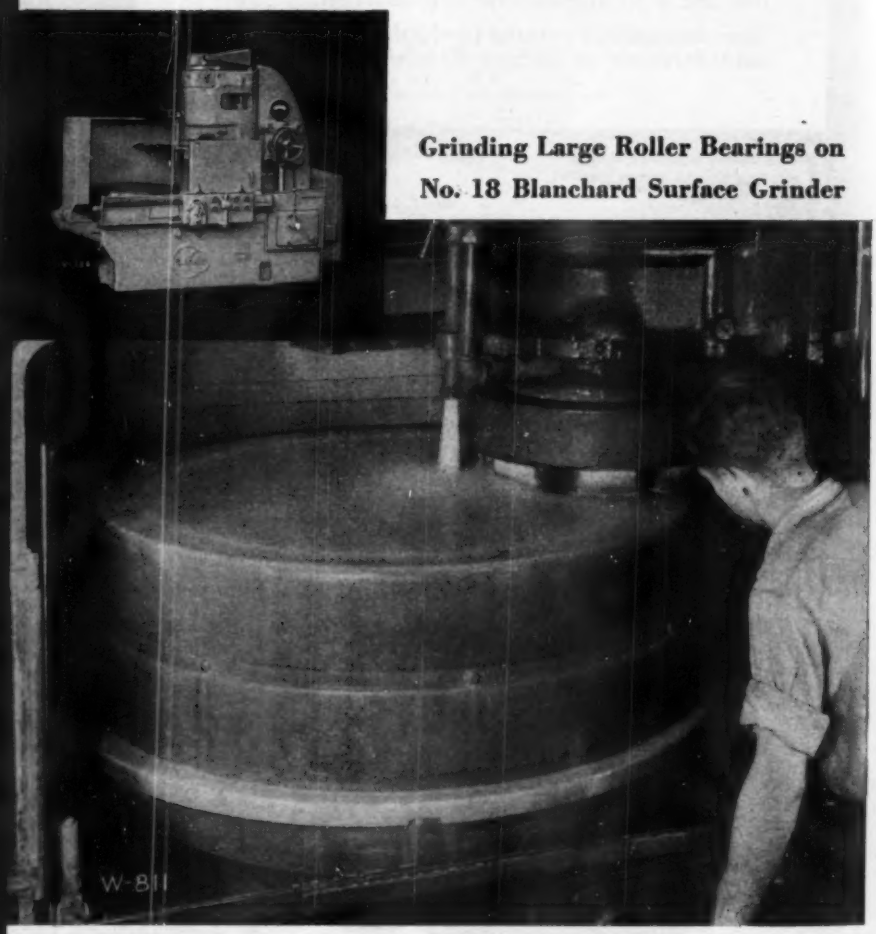
★ . . . . . *Especially valuable on jobs like the one illustrated.*

"PUT IT ON THE BLANCHARD"

The job shown here is another example of large heavy work which may be ground with ease on a Blanchard No. 18 Surface Grinder with extended column and 42" chuck with extension.

These 48" diameter Roller Bearings come to the Blanchard after hardening.

Both sides are ground, removing .050" stock from each side, and size is held to ±.001". The grinding is done in four operations in total time of 4½ hours. Each piece weighs approximately 1800 lbs.



Grinding Large Roller Bearings on No. 18 Blanchard Surface Grinder

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

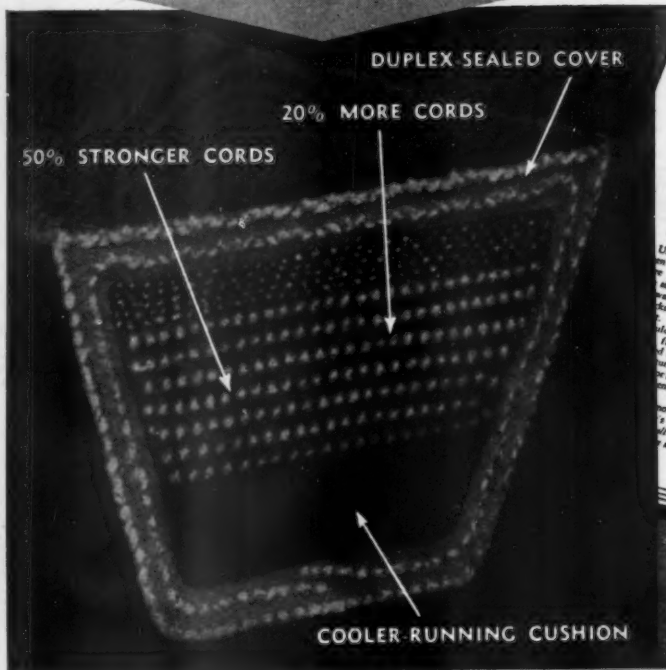
The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS., U. S. A.

HERE'S NEW Double-Trouble for V-Belt Wear!

1 BUY THE BEST BELTS: You'll get the "jump" on maintenance with Texrope Super-7's design-against-wear construction! 20% *more* pulling cords. 50% *greater strength* in every one because they're made by the special Flexon process. That adds up to extra pulling power, less stretch. A cool-running rubber cushion fights flexing heat. Tough Duplex-Sealed cover seals belt against grit, grime, and moisture. When you *do* need new belts *invest in the best* — Texrope Super 7!

2 USE THE BEST CARE: Over 75,000 men in industry are getting a head start on longer V-Belt life because they've got Allis-Chalmers' new handbook: "Plain Facts on Wartime Care of Rubber V-Belts." It gives you the inside story on "how V-belt anatomy affects maintenance"... "good-rule-of-thumb for tension"... a lot of other tips. Excellent for training new men, it's packed with valuable data. For your *free* copy, tear off the coupon and send today.



ALLIS-CHALMERS

TEXROPE SUPER-7 V-BELTS

WE'RE FOR VICTORY — AND THEN FOR PEACE

Trade mark registered U. S. Patent Office. Texrope Super-7 V-Belts are the result of the cooperative research and design genius of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by Allis-Chalmers. Available in all sizes.

ALLIS-CHALMERS MFG. CO.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive free of charge a copy of your "Plain Facts on Wartime Care of V-Belts".

(Name)

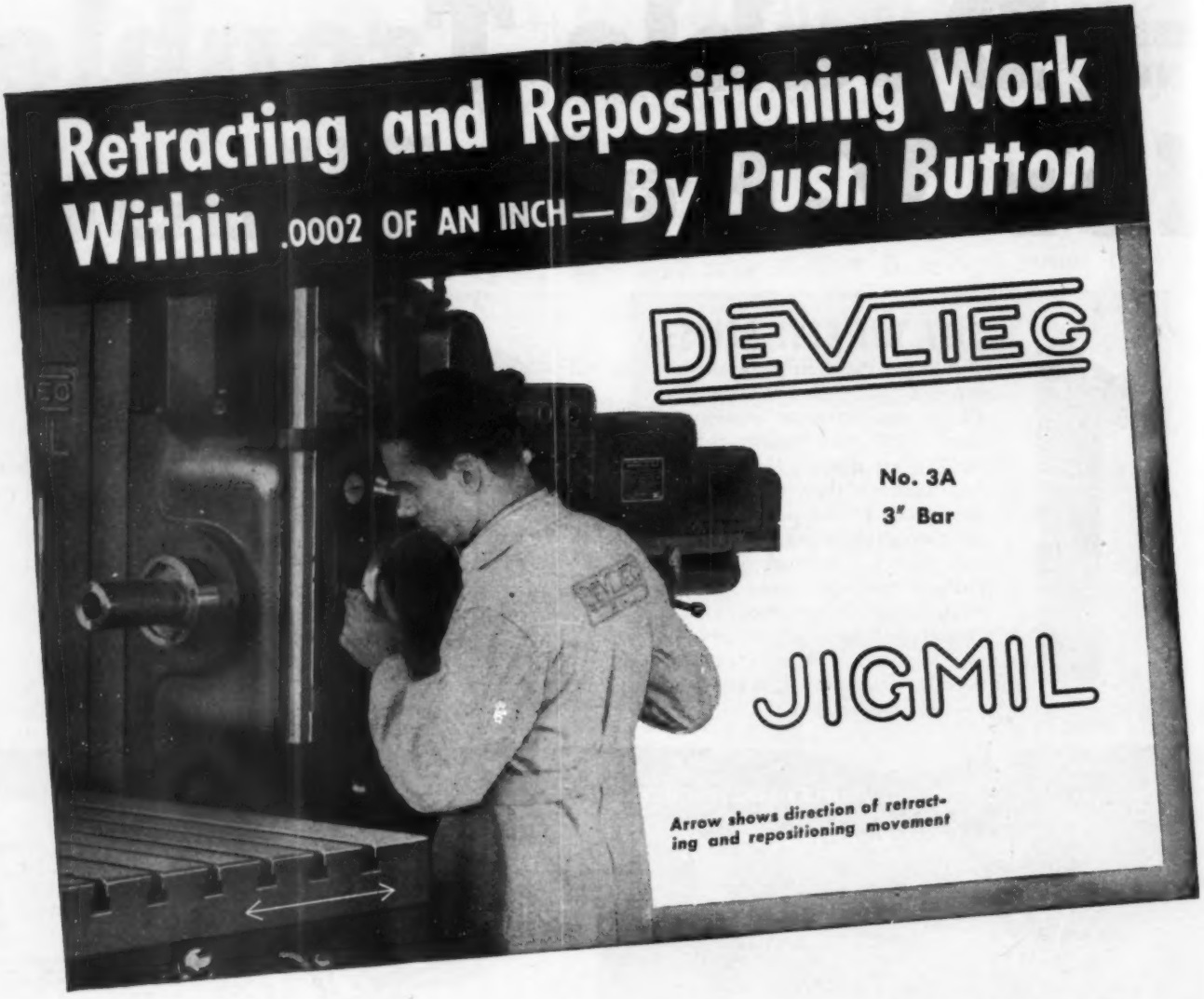
(Title)

(Company)

(Street Address)

(City and State) A 1628-3

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button



The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY

450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular

DEVLIEG MACHINE TOOLS

Remember it? The dim vision of masks and gowns, of lights and gleaming things? They were phantom glimpses in a troubled dream, the night your life was saved — fragments of a shining world of science and strange skills . . .

And every appliance, every gleaming instrument — every sterile garment, swab and bandage — every accessory and apparatus there in the room, that night — was the product of machine tools, or was processed on equipment built by machine tools.

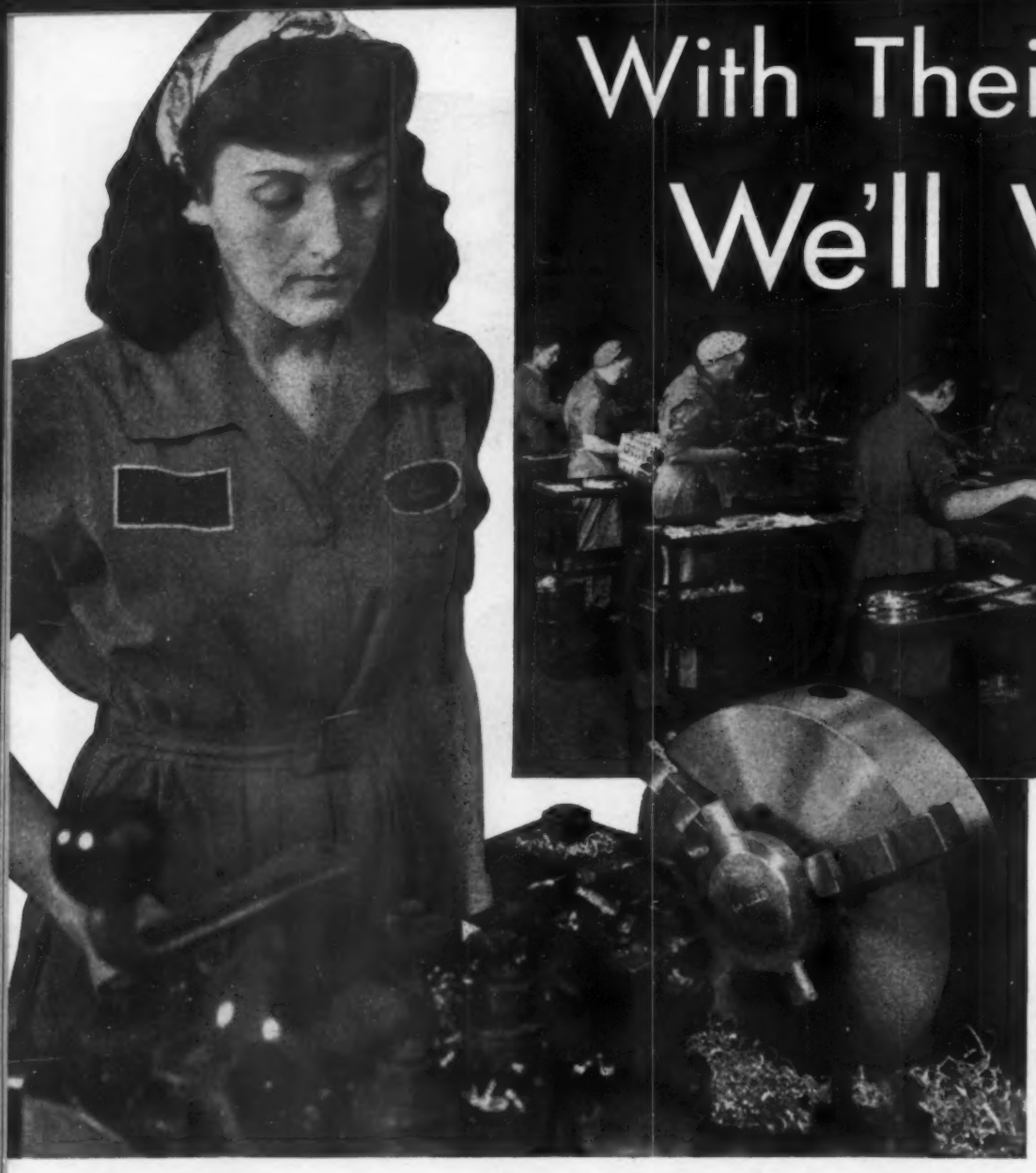
From giant hydraulic presses to the finest internal grinding machines, literally hundreds of machine tools played a part, the night your life was saved.

And of all those unseen instruments that helped to save your life that night, none is more basic to the creation of *everything* that affects your life today than the internal grinding machine.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

With Their Help We'll Win



These women, machining precision parts on South Bend Lathes in a vital war plant, are typical of thousands of women who are doing their part to win the battle of production.

With eager hearts and nimble fingers, thousands of American women are working shoulder to shoulder with men in vital war industries — replacing those who have left their machines to defend their country. And they are doing a fine job of filling men's shoes, for they know that the battle of production must be won to keep their men at the front supplied with the guns, planes, tanks, bullets, and thousands of other things an army must have to be victorious.

Women learn to operate South Bend Lathes in a surprisingly short time. Not that just any girl can become an expert machinist or toolmaker over night. But on certain classes of work—the kind of work you would expect a beginner to do—women are highly successful.

Quick to appreciate quality, women like South Bend Lathes. They like the fully enclosed design with no exposed pulleys, belts, or gears—the smooth operation of conveniently placed controls—the absence of rough edges and sharp corners that might catch their clothing—the dependable precision that enables them to turn out maximum production, even when extremely close tolerances are specified. And, most of all, they appreciate the ease of operation which reduces fatigue to a minimum and seemingly shortens the work-day by hours.

South Bend Engine Lathes and Toolroom Lathes are made in four sizes, 9″ to 16″ swings. South Bend Turret Lathes are available in three sizes. Write for information, specifying size and type of lathe in which you are interested.

"HOW TO RUN A LATHE"

A valuable handbook for apprentice training. Explains the operation and care of engine lathes. 128 pages — 365 illustrations. Price 25c postpaid.

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA

Metro's COMPLETE CARBIDE TIPPED TOOL SERVICE

SEND FOR A COPY OF CATALOG NO. 101
TO GET COMPLETE DETAILS

Available
RIGHT OR LEFT HAND

STANDARD or SPECIAL

For TURNING-FACING-BORING-FORMING OF STEELS-CAST IRON
BRASS-BRONZE-ALUMINUM AND NON-METALLICS

METRO

TOOL AND GAGE CO
4240 PETERSON AVE.
CHICAGO, 30, ILL.

You Get WIDE SPEED

Data from a few actual installations

SPEED RATIO	RPM	APPLICATION	RESULTS
100 : 1	50 to 5000	Drive for magneto testing	Faster and more accurate testing
100 : 1	30 to 3000	Drive for material-testing machine	Constantly increasing rate of tension maintained until material breaks
25 : 1	100 to 2500	Lathe-headstock drive	Increased cutting range and fewer gear changes
20 : 1	85 to 1700	Spar-mill drive	Greatly increased output
3 : 1	1000 to 3000	Drive for machine used to test airplane-propeller governors	More complete test data, as well as speed and precision of testing

NOTE: Likewise, the speed range of Thy-mo-trol drive can be built to suit the requirements of your application. May we discuss your requirements?

GE

THY-MO-TROL DRIVE

Where Else Can It Be Applied?
Drill presses, to increase speed range and the number of kinds of work handled. Grinders, for precise speed selection and improved finishing. Milling machines, to increase variety of work handled and to simplify design. Cable reelers, to maintain constant tension. Conveyors, to match speeds. Also, automatic arc-welder carriages, weld positioners, pumps, boring mills, automatic screw machines, thread-milling machines, tube-forming machines, alternator speed control, paper and cellophane reels, shell lathes, and numerous other applications.

RANGE *and more*

with THY-MO-TROL DRIVE

A-C POWER

D-C MOTOR

IT gives you speed ratios even greater than 100:1. This new electronic equipment makes available the full, wide speed range of d-c motors—*on a-c* power!

Just a single dial provides this smooth, automatic, full-range control. A single dial—small as a radio volume control, and mounted in the push-button control station—gives complete adjustment of motor speed, from zero to maximum. Thus, you can easily and quickly obtain the exact speed you want, whether, it be for roughing or fine finishing.

Here Are Six OTHER Advantages:

1. Stepless speed control
2. Constant speed under changing load
3. Smooth, fast, constant-current acceleration
4. Low maintenance
5. Speed can be preset before starting
6. No stop for speed change

A Complete Drive

Thy-mo-trol drive takes a-c power from your supply line and, through its d-c motor, delivers torque to your load over a wide range of speeds. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single, compact control station.

How to Buy Thy-Mo-Trol Drive

Standard Thy-Mo-Trol drives can be obtained in ratings from fractional-horsepower sizes up to 10 hp; higher ratings can also be provided.

This electronic motor control makes possible improved machine design, performance, and operating technique. In order to be sure that you get the full advantage of this new drive, G-E engineers want to consider each application as an individual case. We suggest you get in touch with our local office, giving complete information about your machine for which the drive is required. General Electric, Schenectady, New York.

BUY WAR BONDS

ANOTHER G-E "FIRST" IN INDUSTRIAL ELECTRONICS

GENERAL ELECTRIC

LEES-BRADNER

Heavy Type

THREAD MILLER

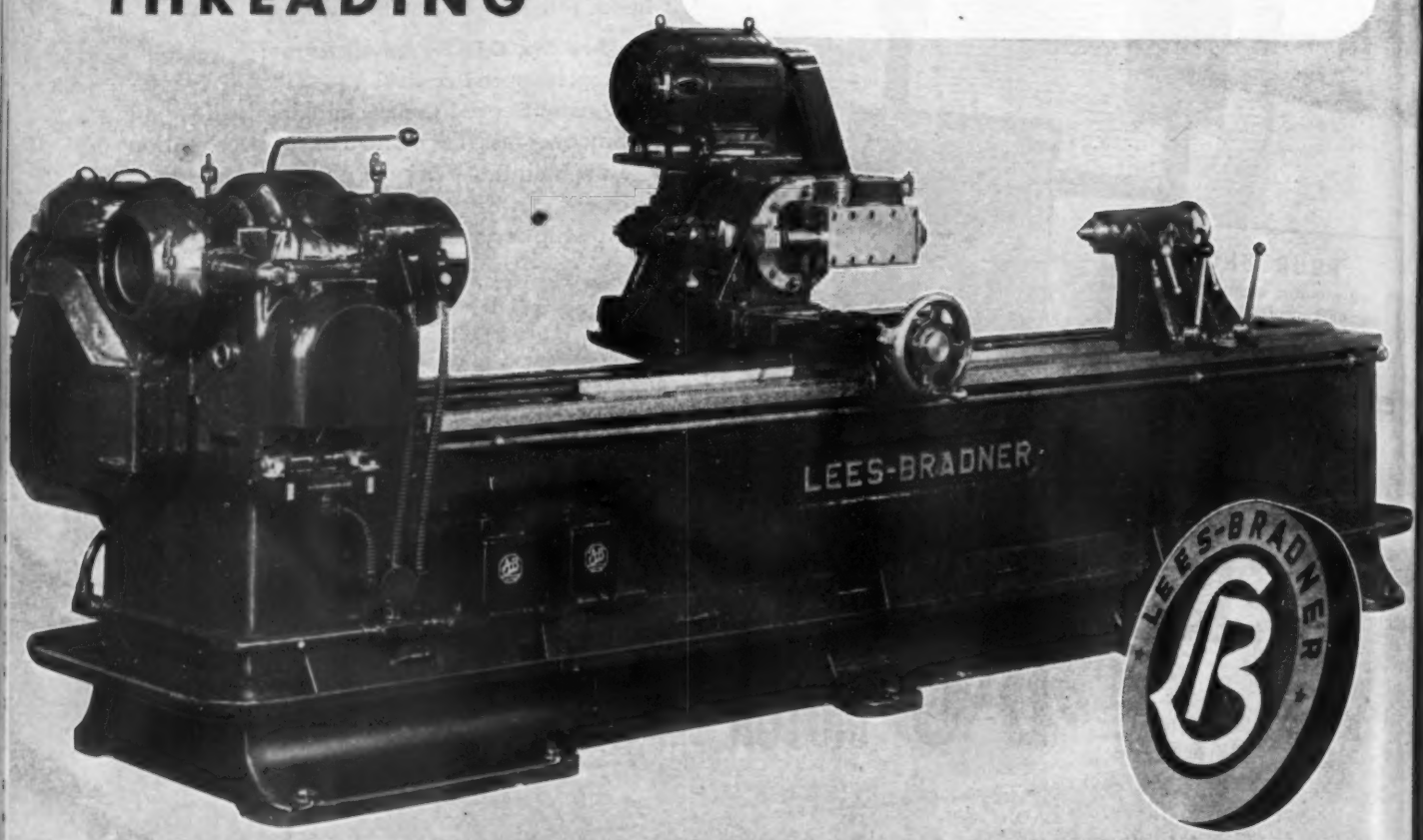
•

A HEAVY DUTY MACHINE FOR *Precision* THREADING

● Rugged from the base up—capable of feeds and speeds greatly in excess of previous practice, the Heavy Duty Lees-Bradner Thread Miller is showing superlative results both as to precision and productive capacity.

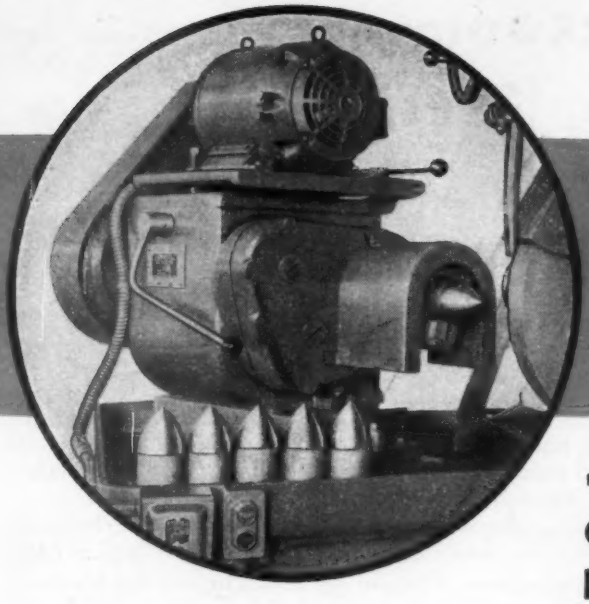
For high production to close tolerances—put your heavy duty precision threading jobs on a Lees-Bradner H T Thread Miller.

Why not consult Lees-Bradner Engineers on your precision threading requirements?



The LEES-BRADNER *Company*

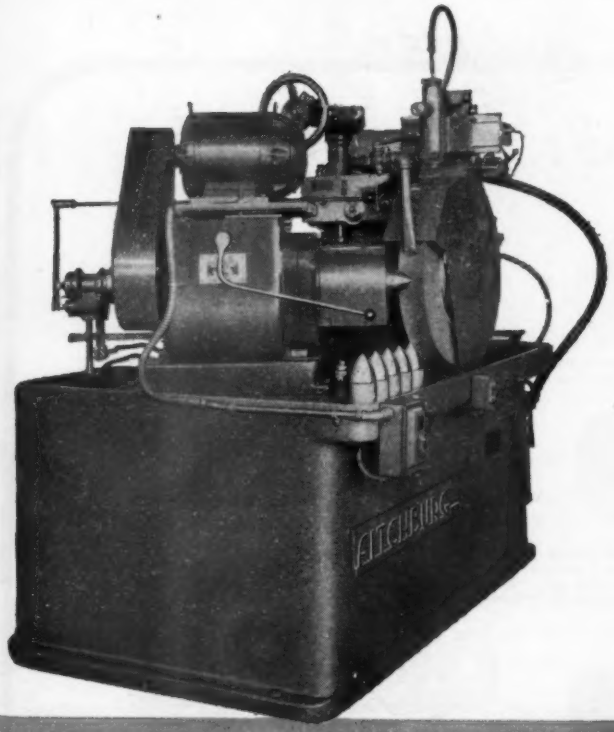
CLEVELAND 11. OHIO. U.S.A.



on Grinding jobs like this

. . . FITCHBURG OFFERS SPECIAL ADVANTAGES IN MASS PRODUCTION

This Fitchburg special Chucking Grinder with a heavy duty headstock, is designed for grinding the ojive of armour piercing shells. The wheelhead is a Fitchburg Standard Bowgage Unit carrying a 24" x 3½" face wheel. A hydraulic form trueing device is mounted on the wheelhead.



To operate this machine the operator places the shell in the open jaw chuck, then, by pushing a ball lever forward, closes the chuck, clamping the work piece at a definite distance from the bottom of the shell. To start the work rotation, operator depresses the long lever and pushes the button to start the automatic grinding cycle.

When installing special precision grinding equipment, it is well to remember that the Fitchburg Bowgage Grinding Wheelhead is a standard unit. It can be remounted on standard machines, or on new special bases, for operations other than the one originally specified. This feature protects your investment.

. . . Write today for folder giving complete details.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

INCREASED PRODUCTION! MORE ACCURATE WORK . . SUPER-SMOOTH FINISH

with the SUNNEN "MA" PRECISION HONING MACHINE

ARMY
NAVY
The coveted Army-Navy "E" waves over the Sunnen plant—evidence of the important part Sunnen equipment is playing in the war effort.

On internal cylindrical surfaces from .185" to 2.625" in diameter, the Sunnen Precision Honing Machine will handle production jobs to within .0001" limits — and produce a super-smooth finish of 2 to 3 micro-inches. In actual practice, jobs have often been held to .000025".

And, in addition, production has been increased — in some instances, up to 500% — with fewer rejects and absolute interchangeability of parts.

Skilled labor is unnecessary—new workers can be trained in a few hours. Low in cost—economical to operate. No jigs or fixtures necessary. Can be set up in less than one minute. Guaranteed accuracy—super-smooth finish.

A Sunnen engineer will gladly call and show you what the Precision Honing Machine can do on your job—in your plant. Or, if you prefer, write for free bulletin giving complete information.

SUNNEN PRODUCTS CO., 7941 Manchester Avenue, St. Louis, Mo.

Canadian Factory: Chatham, Ontario

SUNNEN

On Jobs Like These!

Carbureter Idler Valve Jet. Hole is honed after reaming for smooth action.

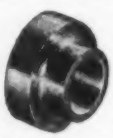
Roller Bearing Outer Race. Finish improved from 12 micro-inches to 2 micro-inches.

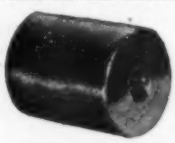
Bearing. A very small part. 2 micro-inch finish necessary.

Carbureter Idler Pump. Smooth, straight-line finish in blind hole prevents piston leakage.

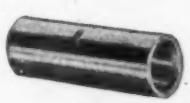
Ceramic Insulator. Honing used to eliminate roughness inside ceramic tube.

Hydraulic Metering Valve Stem. Hole .156" in diameter; reamed, heat treated, and then honed. Honing 3 times as fast as previous method.


Aircraft Instrument Panel Control Wire Bushing. Hole .187" diameter — held to .0002", stock removal .001", sixty per hour.


Header Die. Life of header dies increased 3 to 9 times over lapping. Knock out pin breakage practically eliminated.

Aircraft Hydraulic Brake Cylinder. Honing 3 times faster than lapping—and gave a straighter hole.


Aircraft Piston Pin. Sunnen honing is twice as fast and gives a cleaner, better looking pin.

Cast Iron Valve Stem Guide. ½ to one thousandth removed —220 pieces per hour. Better finish and straighter hole.

Stainless Steel Load Compensator Valve Seat. Hole is honed to .0002" limit.

Shell Loading Die.

Idle Valve Guide. Honing after grinding holds a .0002" limit necessary for accurate idling.

Aircraft Valve Tappet Roller. Honed after grinding to give 100% bearing surface.

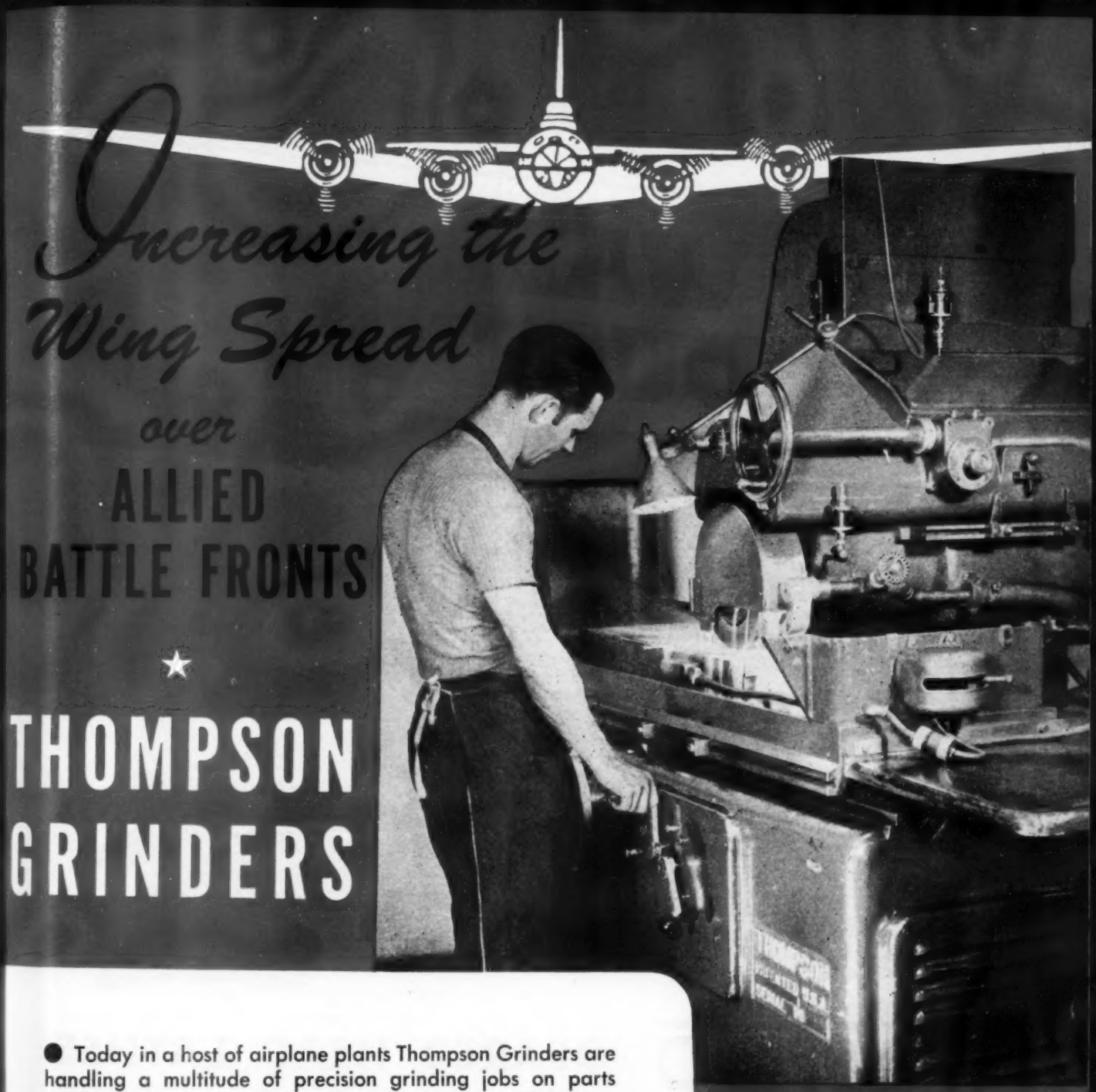
Hydraulic Control Bushing. Honing gives straight round hole after rough reaming.

Aircraft Carbureter Operating Valve Sleeve. Sunnen honing eliminates distortion from assembling operation.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Compressor Yoke. Alignment maintained and better finish produced.

Mild Steel Clevis. Honing corrected errors of previous operations and maintained true alignment of two holes.



Increasing the Wing Spread

over

ALLIED BATTLE FRONTS

★

THOMPSON GRINDERS

● Today in a host of airplane plants Thompson Grinders are handling a multitude of precision grinding jobs on parts slated for the various planes of our air forces on all fighting fronts.

Illustrated is a Type C Thompson Grinder maintaining close limits of accuracy and a superb finish at a high production rate in one of America's leading aircraft plants.

A few of the leading characteristics of Thompson Grinders are freedom from vibration—rigid construction—high speeds —ease and quick action of control.

If your work calls for close tolerance grinding—smooth finish—and high production—put it on a Thompson.

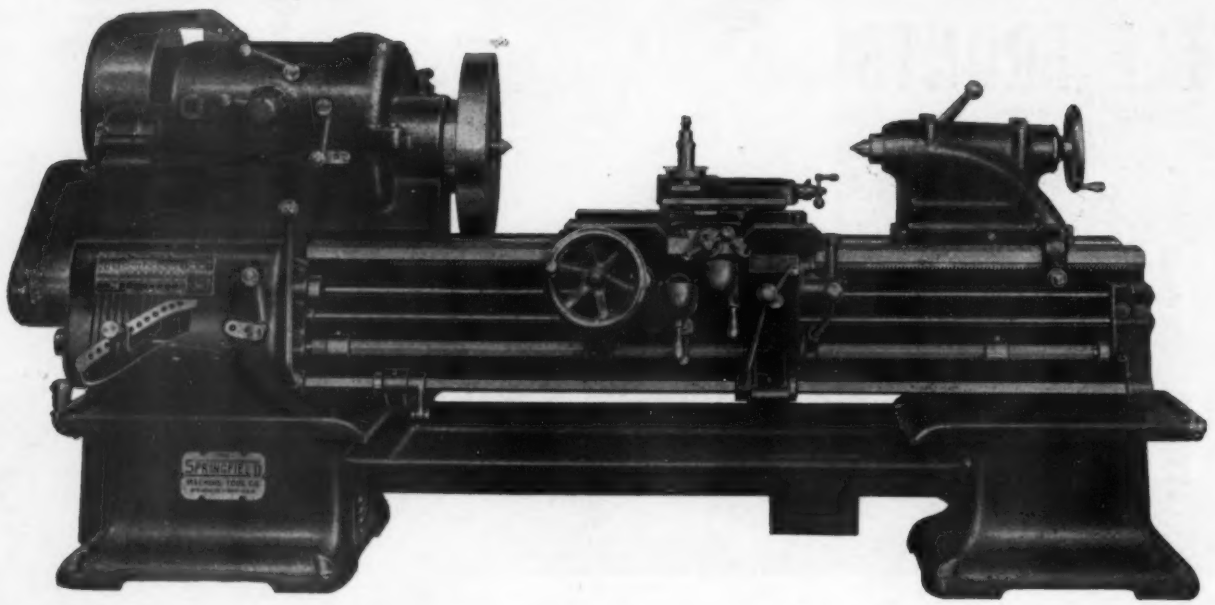
THOMPSON BUILDS

a complete range of types and sizes to cover every grinding need. Largest Type C 36″ x 36″ x 240″.

THE **Thompson** GRINDER CO.

SPRINGFIELD OHIO

FOR WAR PRODUCTION



SPRINGFIELD GEARED HEAD LATHES

In the Machine Tool industry's current expansion program to increase production, SPRINGFIELD Geared Head Lathes are playing a prominent role . . . in ever greater numbers, SPRINGFIELDS are being tagged "FOR WAR PRODUCTION". In turn, this demand has caused us to expand our own facilities and services to turn out more lathes, so that more guns, tanks, airplanes and other fighting tools can be economically and efficiently produced. As always, those saving features of SPRINGFIELD Geared Head Lathes—maximum gearing efficiency . . . ingenious attachments . . . rugged construction . . . superior lubricating and power transmission systems, and many more—are showing themselves to be the answer to many problems, particularly where sustained production is the order of the day. For War Production now, and normal operations later, choose SPRINGFIELD—Geared Head Lathes in sizes from 14" to 30". Write for circular #162, concerning prices, delivery dates, etc.

The SPRINGFIELD MACHINE TOOL Co.

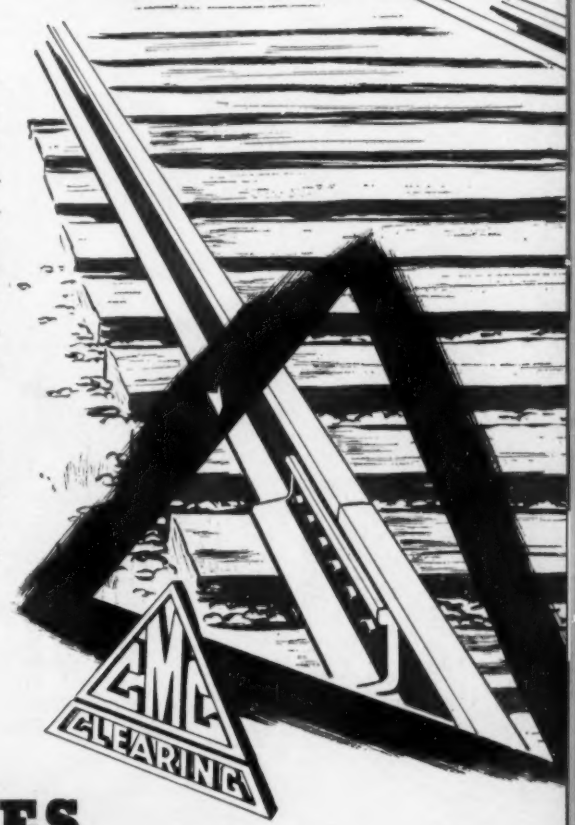
SPRINGFIELD OHIO U.S.A.

Nimble-Fingered COLOSSUS

Forging rail joints or rail tie bars is the job this 2500-ton capacity Clearing Hydraulic Press does with exceptional speed and efficiency. It handles and forges automatically any of the great variety of rail joints used by the railroads, no matter what the length or profile may be.

Heated rolled bars are fed on a conveyor from furnace to press. During each upstroke, the press feed picks up a new bar as well as the joint which has just been forged. Then during the downstroke, the new bar is placed on the die ready for forging at the finish of the stroke and the forged joint previously picked up is discharged directly into the quenching tank. This completely automatic production cycle turns out tie bars at the rate of 600 per hour.

The engineering skill and production facilities which created this nimble-fingered colossus can serve you equally well. The Clearing organization is able and willing to be of assistance on your press problems, especially those of the "can't-be-done" variety. Get the benefit of this help—consult Clearing. CLEARING MACHINE CORPORATION, 6499 West 65th Street, Chicago 38, Illinois.



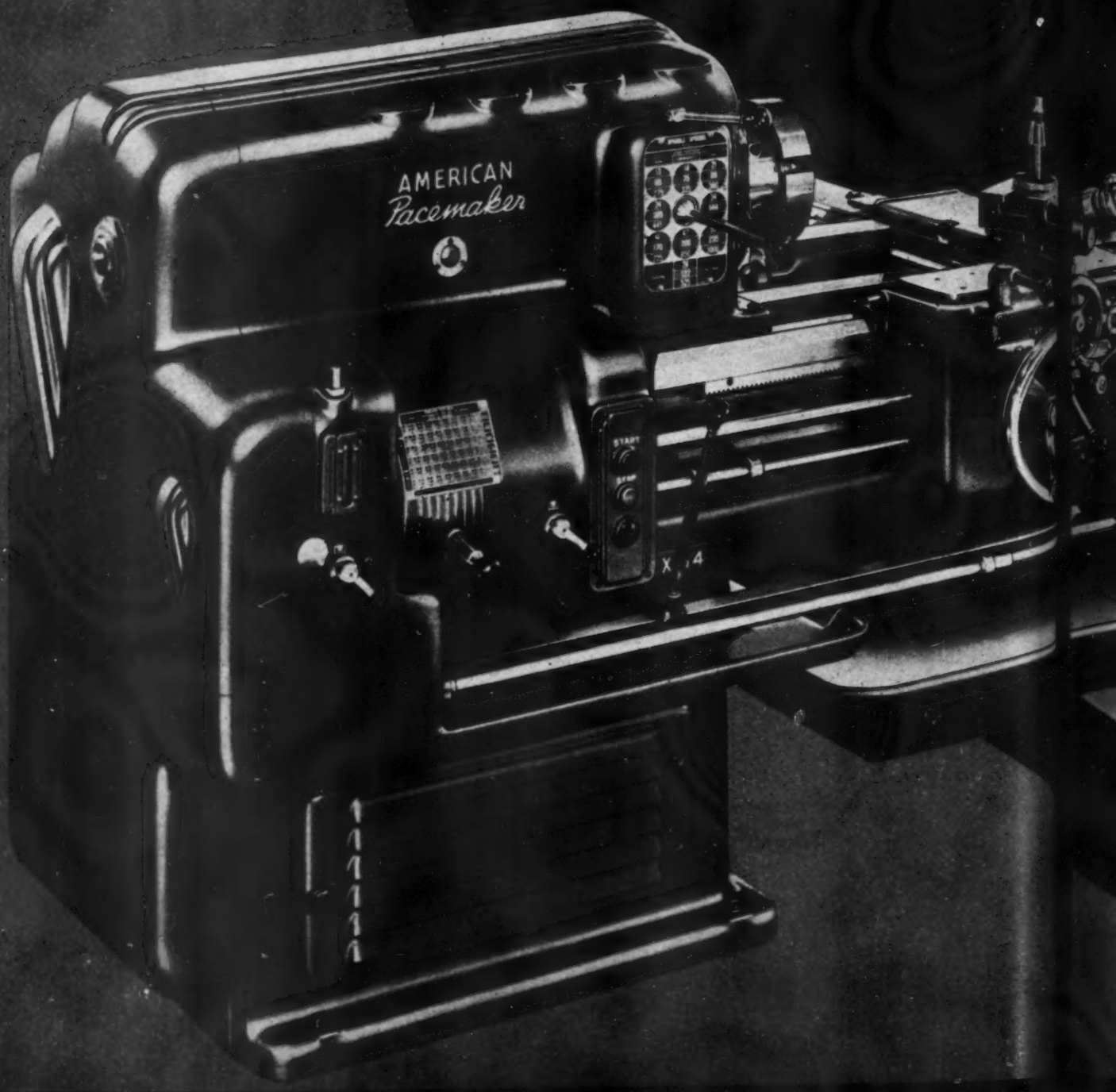
CLEARING PRESSES

MECHANICAL AND HYDRAULIC

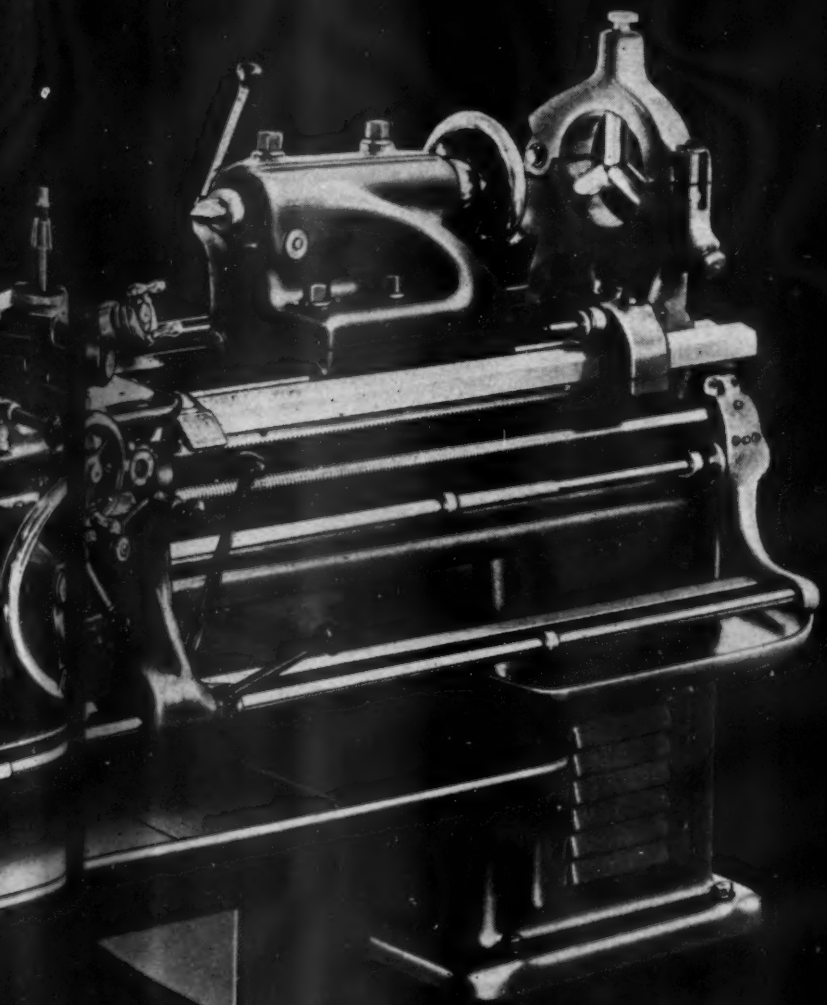
AMERICAN

FOR
ALL-OUT
PRODUCTION

PROTECT YOUR SHOP AGAINST
MAN-POWER SHORTAGE BY
UTILIZING THE EXTRA PRODUCING
CAPACITY OF . . . .



"AMERICAN" *Pacemaker* LATHES



The danger to production resulting from the induction of manpower from production shops, can be minimized, by replacing slow, inefficient, effort-consuming lathes with fast, convenient, easily-handled "AMERICAN" Pacemakers.

Time and again an "AMERICAN" Pacemaker operator easily produces as much work as two equally efficient operators on old machines. On the basis of manpower and machine productive power alone, the shop equipped with "AMERICAN" Pacemaker Lathes is in a far better position to maintain all-out production with fewer men and machines than the shop that clings to its old machines and the hope that it will not be caught by a shortage of machine operators.

Insofar as quality of work is concerned, the "AMERICAN" Pacemaker can be depended on for outstanding accuracy at all times and under all conditions.

LATHES
RADIALS
SHAPERS

The
AMERICAN
TOOL WORKS CO.
Cincinnati, Ohio

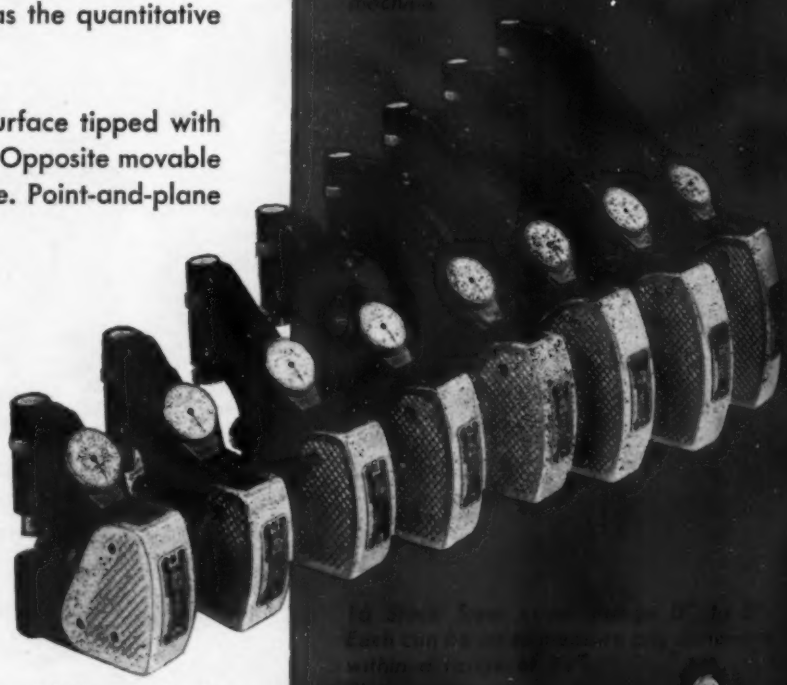
STANDARD
Dial Snap Gage

ACCURATE as a Bench Comparator but FAST and PORTABLE!

HERE'S A GAGE that combines PORTABILITY with speed in use and absolute accuracy on dimensions as fine as .0001". STANDARD Dial Snap Gage is portable and easy to handle as a conventional snap gage, yet has the quantitative accuracy of a stationary instrument.

Adjustable gaging pin has a serrated flat surface tipped with tungsten carbide that practically *defies wear*. Opposite movable pin has mushroom top, also tungsten carbide. Point-and-plane construction assures continued, accurate readings whether instrument is set by cylindrical or flat standards.

STANDARD Dial Snap Gages speed inspection, guard against rejects and material spoilage and eliminate human variations not only on precision work but also where tolerances are comparatively liberal. Write for Special Bulletin.



FEATURES

1. High precision indicator approximately 1" in diameter graduated .0001". Bezel rotates for convenient setting.

2. Measuring anvil tipped with tungsten carbide. Indicator protected against shock by sudden applications to measuring pin.

3. Tungsten carbide tipped adjustable anvil has flat lapped serrated surface. Minute chips and dust readily clear from it, helping insure accuracy.

4. Adjustable, spring-cushioned safety stop reduces jar, helps hold work in correct gaging position.

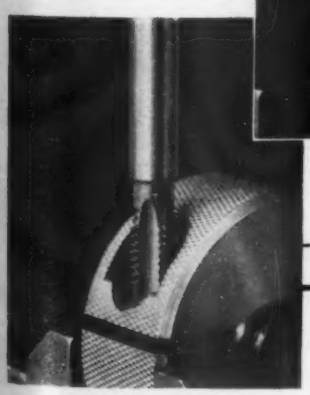
5. Air space between grip and body of instrument protects against hand heat, further safeguards accuracy.

STANDARD GAGE CO., INC., Poughkeepsie, N.Y.

8 Speeds quickly available FOR FULL RANGE WORK

DRILLING

COUNTERBORING



TAPPING

MOVE UP THE SCHEDULE · WIN THE WAR QUICKER

• Footburt sensitives are built with the wide range of speeds and with the power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period.

Write, wire or phone fo. prices and delivery information

No. 2 MACHINE WITH BACK GEAR—8" or 12" Overhang • ⅝" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 R. P. M. • 280 to 3450 R. P. M. • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit

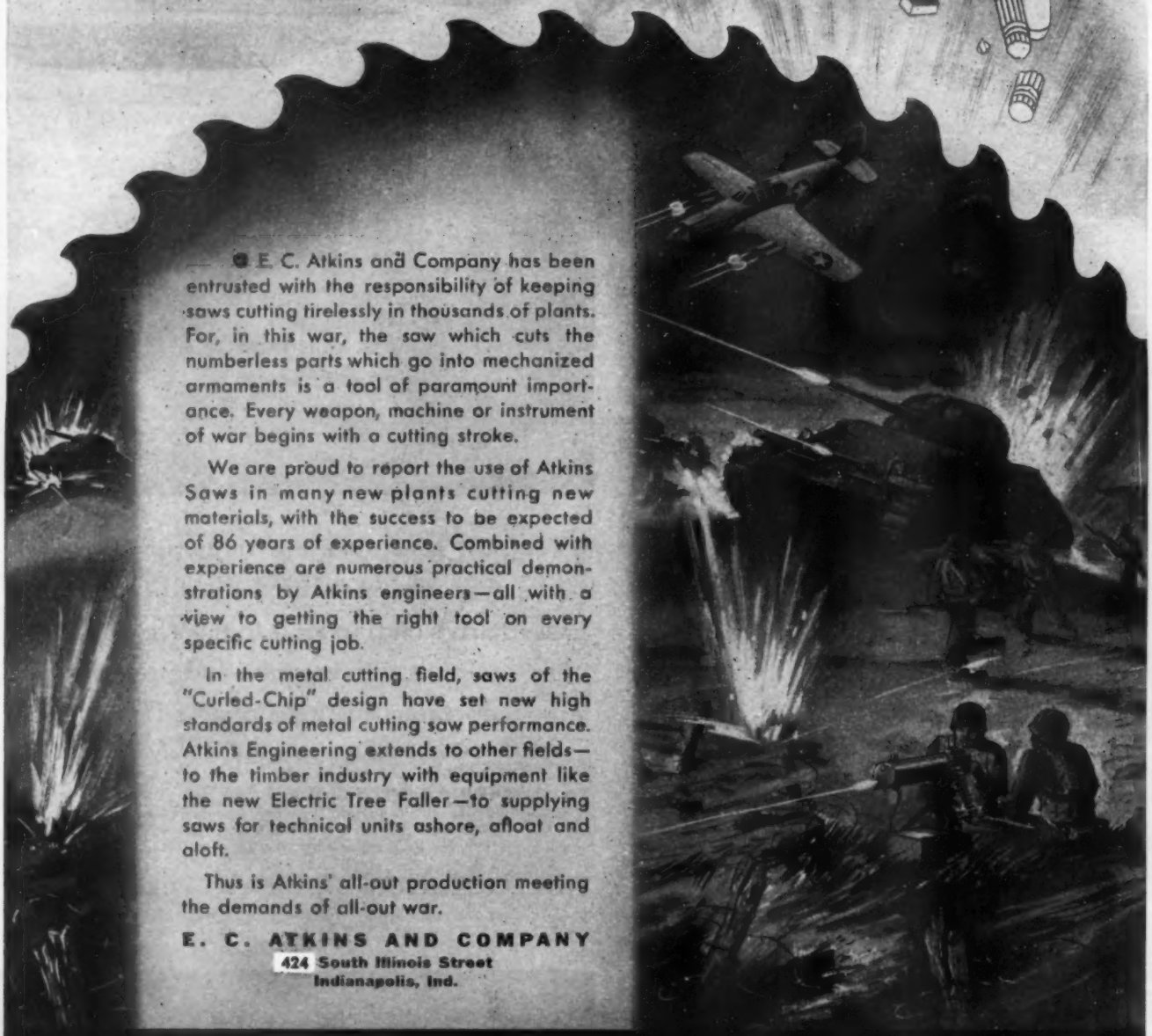
THE FOOTE-BURT COMPANY • Cleveland, Ohio

Detroit Office: General Motors Building

FOOTBURT *Sensitive* DRILLING MACHINES

ATKINS

THE SAW IS MIGHTY FOR WAR SUPREMACY



E. C. Atkins and Company has been entrusted with the responsibility of keeping saws cutting tirelessly in thousands of plants. For, in this war, the saw which cuts the numberless parts which go into mechanized armaments is a tool of paramount importance. Every weapon, machine or instrument of war begins with a cutting stroke.

We are proud to report the use of Atkins Saws in many new plants cutting new materials, with the success to be expected of 86 years of experience. Combined with experience are numerous practical demonstrations by Atkins engineers—all with a view to getting the right tool on every specific cutting job.

In the metal cutting field, saws of the "Curled-Chip" design have set new high standards of metal cutting saw performance. Atkins Engineering extends to other fields—to the timber industry with equipment like the new Electric Tree Faller—to supplying saws for technical units ashore, afloat and aloft.

Thus is Atkins' all-out production meeting the demands of all-out war.

E. C. ATKINS AND COMPANY
424 South Illinois Street
Indianapolis, Ind.

Cutting a Name for Themselves
IN EVERY PHASE OF WAR PRODUCTION

DEEDS--NOT JUST WORDS

merica's airplane makers talk with deeds, not words. The roduction miracles of last year are the reason for our air periority today. Their workers always do their best — d their best is getting better.

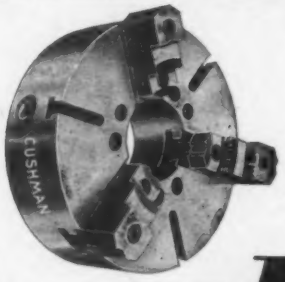
he big reason for this is the hundreds of Mult-Au-Matics w at work on America's airplane engines. On many jobs y have more than tripled production, while freeing cious manpower and floor space for other work.

Two Bullard Type "D" Mult-Au-Matics machining airplane engine cylinder sleeves for a famous Eastern manufacturer.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT

AS FAR AS



chucks

ARE CONCERNED...

HERE ARE 3 THINGS YOU CAN DO TO HELP THE W. P. B. CAMPAIGN

1 See that the RIGHT Chucks and the RIGHT jaw equipment are used for each tooling set up. This sounds elementary, but it is surprising how many chuck troubles are caused by over-expansion of jaws and overloading of chucks. Correct use of soft blank top jaws, machined to accommodate the work, also saves set-up time and speeds production.

2 See that chucks are properly lubricated and kept clean. Dirt and chips or grinding wheel abrasive particles will surely cause trouble in the precision bearing surfaces of chucks and the inaccuracies that develop necessitate hard-to-get replacements.

3 See that operators understand that spindle nose threads and bearings, while they look plenty husky are most accurately ground and fitted. They should be kept scrupulously clean. No chuck should ever be *forced* into seating, otherwise inaccuracies will develop that will be multiplied in the work and will again necessitate replacements or time-and labor-consuming repairs.

CUSHMAN

A World Standard for PRECISION

We have prepared "CHUCK-CHECK" cards that point out the simple rules of good chuck maintenance. We will be glad to send you a supply for distribution to your operators. and remember that Chucks are TOOLS.

The Cushman Chuck Co., Hartford, Conn.

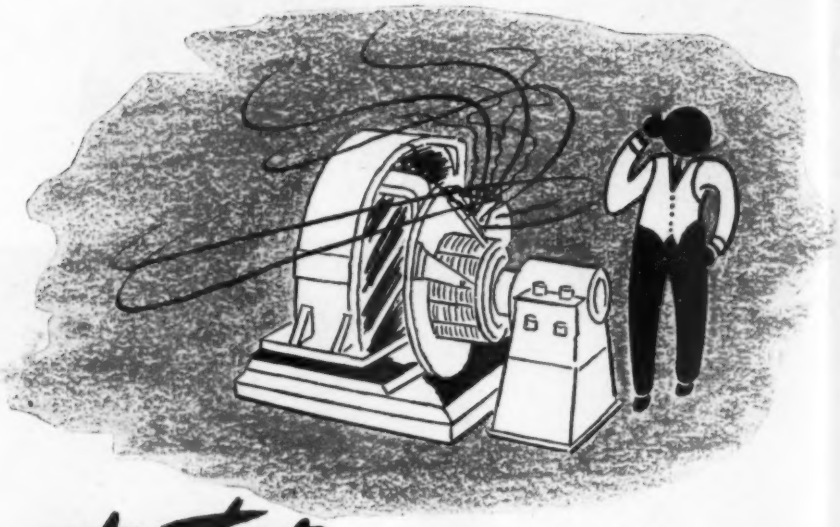
HARDINGE-SJOGREN SPEED COLLET CHUCKS

A HARDINGE-SJOGREN Nose Type Speed Collet Chuck enables you to get full value from your investment in tool-room lathes, engine lathes and milling machines. It gives greater capacity, saves time, increases accuracy and assures better results.

The amazingly fast action of the HARDINGE-SJOGREN Speed Collet Chuck gives it full right to its name. An almost effortless turn of the handwheel, one way or the other, automatically opens or closes the collet, releasing or gripping the work as desired. Its grip is adjustable and sure.

Available in three sizes: 1", 1⅜" and 1¾"capacity

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



Commutator GROUNDED AT 6 P.M.

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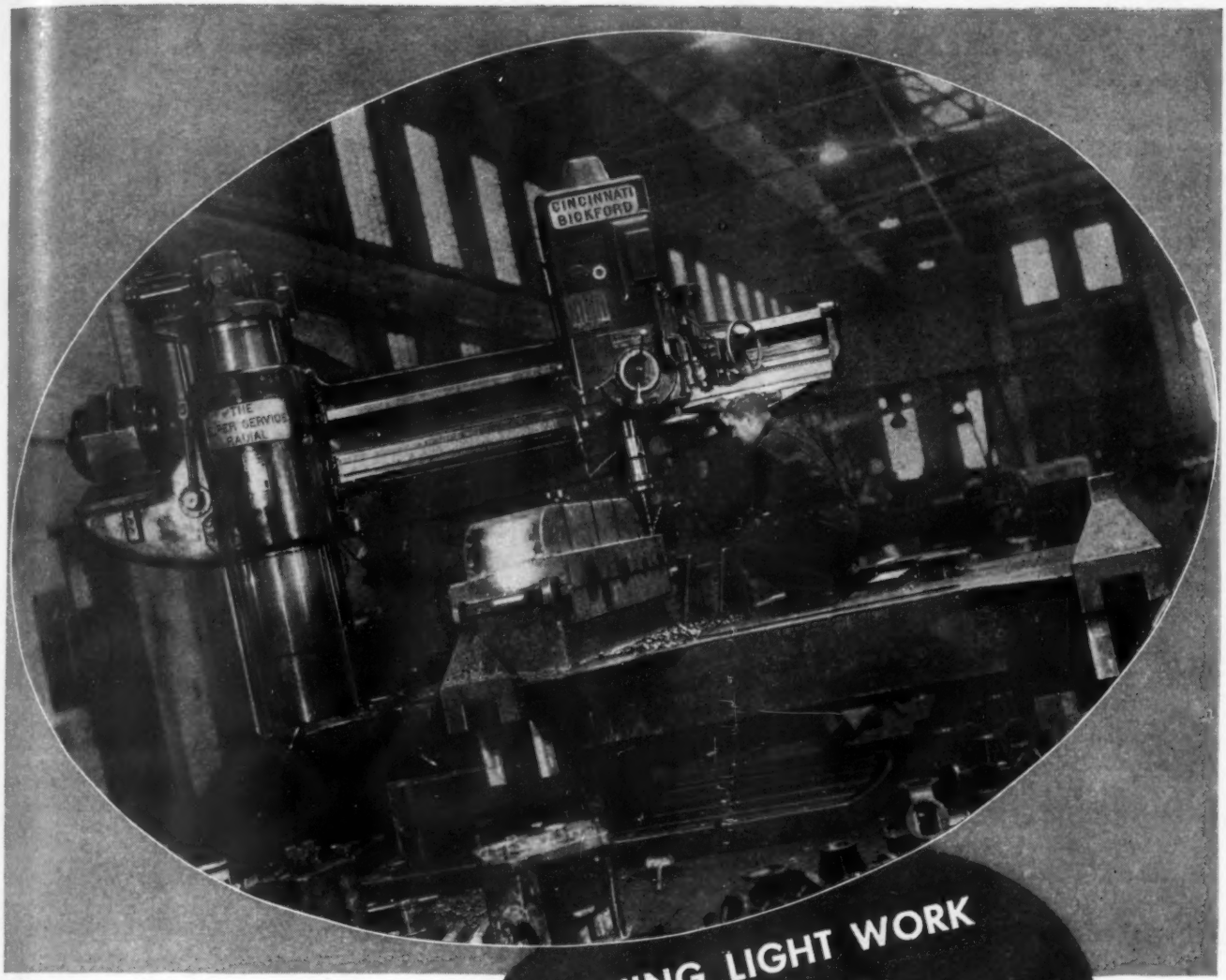

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What's In This Issue

HAROLD HODGES

Bending Without Buckling

When the International Harvester Company undertook to form a large number of copper tubes on a heavy contract it ran into the usual bugaboos —collapsing, wrinkling and folding. These troubles were avoided by the use of special fixtures together with flame-annealing or sand-filling. The result was tubes that maintain specified pressures and at the same time permit the passage of steel test balls. Harold Hodges, of the company's McCormick Works, tells how it was done. Page 80.

Masking by Ford

Covering portions of machine parts to prevent adherence of paint takes longer than the spray painting operation that follows. So, in searching for manufacturing economies in making Pratt & Whitney aircraft engines, the Ford Motor Company hit upon the idea of conveyorizing the process. The resulting set-up, which proved a big success, is accurately described in these pages. Page 75.

A Line on Spiders

Spiders tended to become a bottleneck at the Republic Aircraft Products Division, The Aviation Corporation. These aircraft engine components required extremely fine finish and close machining tolerances. The production line finally set up for this job included tooling that met all the stringent specifications and boosted production some 200 percent — another instance where American industry has met the demands of our armed forces for more and better products. Page 89.

Pointers on Plastics

Plastics have intrigued popular imagination because of their attractive possibilities in many kinds of products. They are readily formed into finished parts; they are durable, non-corrosive, dielectric and pleasing in appearance. The development of new types with varied physical characteristics has been rapid—so rapid in fact that it is difficult for many users to keep pace with them. Consequently, the twelve-page section appearing in this number is timely. It reviews the major types of plastics now available and gives practical hints on how they may be molded, machined and press worked. Page 97.

I's to T's

A lot of I-beams, rolled for bridge construction, could be used on Liberty ships by removing one flange to form a T. The Phoenix Iron Company first tried burning, then built an abrasive cut-off machine for the work. The equipment is portable and can be used on a wide variety of jobs. Besides it gives cleaner, more accurate beams. Page 83.

Milling Jobs

H. A. Frommelt, Kearney & Trecker Corporation, contributes another picture spread on toolroom milling. The details of each set-up are described in captions. Such difficult cuts as dovetails, T-slots and internal serrations look easy when you know how. And Mr. Frommelt shows how. Page 84.

Props in Production

Grinding operations on aircraft propeller blades are complicated by the difficulty of holding such an irregular shape. The use of a special shuttle, or work-holding spool, was developed by the American Propeller Corporation. The blades are set up in the shuttle which carries them through seven separate grinding operations. Result: savings per blade of 1½ hours. Page 95.

Sheet Cutting

A lot of useful data are packed into two reference sheets on cutting sheet metal. This information is based on findings of Douglas Aircraft Company engineers. It summarizes in concise form the equipment used, design considerations and the way to get most efficient production. Page 109.

HUGH L. SAMUEL

Green Workers on Shells

Starting a shell plant in a community with few skilled workers posed a formidable training problem. That is just what the Holfast Rubber Company was up against in organizing its Georgia factory for producing 40-mm. high explosive shell. Good preliminary planning overcame the difficulties with emphasis on pre-employment and pre-production training. Carefully worked out operation sheets helped to introduce the worker to his job. The program is described by Hugh L. Samuel, special field representative, Bureau of Training, War Manpower Commission. Page 78.

COMING

Next number will come out a few days prior to the National Metal Congress. Its editorial contents will, therefore, tie into the event by telling a lot about metal processing.

A few of the topics covered will be the use of quenching dies, welded tool construction, aluminum riveting and cleaning aircraft engines. In addition a special section on "The Working of Cast Copper Alloys" will appear.

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SHAPERS BRAKES SHEARS

American Machinist

ESTABLISHED 1877 • BURNHAM FINNEY, EDITOR

This long conveyor bench is typical of mass production methods devised by the Ford Motor Company for manufacture of Pratt & Whitney engines. The first of its kind in the aircraft engine industry, this conveyor is used to speed affixing of masks to castings to stop off paint spray from machined surfaces and holes

Ford Masks Engine Parts On a Conveyor

Make-ready of aluminum and magnesium castings for spray painting is now handled at the Rouge Plant in a manner that prevents scratching, saves time

CONVEYORIZED MASKING, according to the Ford Motor Company, is from six to ten times faster than hand methods of stopping off paint spray from machined surfaces of Pratt & Whitney engine components. The new method saves handling and minimizes scratches upon machined aluminum and magnesium alloy castings such as power sections, blower section, reduction gear housing and super-charger housing. The sharp reduction in masking time per part is achieved by a combination of conditions: (1) the conveyor transports the piece, (2) convenient fixtures are supplied for use on the conveyor to turn bulky parts, (3) masks developed by Ford workers fit snugly, are conveniently applied.

Station-type assembly of masks is employed. Fifty people, mostly women, work on both sides of the conveyor. Masks and corks are brought to the proper stations in complete sets placed in boxes. Assembly fixtures, such as turntables, are returned by using the return side of the canvas conveyor belt as the carrier.

In comparison with bench assembly of masks, the conveyor saves considerable floor space. Moreover it makes possible a straight line work flow through a compact department. Viewed from the loading end, the conveyor forms one long side of a rectangle. The far end of the layout consists of water-wash spray booths served by an

overhead chain conveyor. This conveyor takes painted castings through an infra-red tunnel-type drying oven that comprises the third side of the rectangle. Finally, the castings move through a cooling chamber near the starting end of the conveyor.

A considerable portion of the time saved in masking P. & W. parts on the conveyor is attributable to the masks and fixtures employed. These have been developed by Ford workers in the department. Any person with an idea for a mask has been given time to work it out in an experimental shop located within the confines of the painting department. A full assortment of turning, sawing and sanding machines is provided in the shop. Some workers have shown considerable skill in executing their ideas, others have required help by more experienced men or from the mechanical design department.

A turntable supports an engine power section while the worker snaps half-circular masks over the cylinder openings. Easy rotation of the piece on the turntable speeds the masking operation, reduces manual effort

A twist of the wrist and the turnbuckle draws in wedges to expand a mask into the machined flange of the reduction gear housing. In the foreground are seen a complete set of masks for this part, including the combination conveyor hanger and mask for the propeller shaft hole

The installation of an experimental department within a manufacturing area is unusual even in the Ford Motor Company, whose founder has always encouraged trade training. In this case, the experimental shop has been the means of translating suggestions into concrete improvements in masks and masking fixtures with minimum lost motion. Besides stimulating workers to work out their ideas into practical form, the experimental shop has served to equip a relatively new manufacturing department with production conveniences in a relatively short time.

Masks are made from pressed bakelite, because this material is resistant to cleaning solvents, withstands handling, is light in weight, and can be machined to a snap fit in large openings. Holes from $\frac{1}{8}$ to 3 in. in diameter are plugged with corks.

Turntable for Bulky Parts

Several types of masks are in use. Half-round cylinder openings in the power sections are covered with conventional plate masks fastened in place with cam, lever, or spring actions as circumstances of the application dictate. The placement of these masks is facilitated by a turntable developed by a Ford worker. This device consists of a circular wood base, either four or six pipe uprights and a platform consisting of two pieces of bakelite, one of which turns on a ball bearing. Light in weight, and easily placed anywhere on the conveyor belt where it rides firmly, this turntable enables the operator to position the power section and snap the masks in place much faster than would be possible on a bench. In addition, chances of scratching the machined faces of the casting are practically nil.

Three other types of masks are employed for sealing openings in the reduction-gear housing. One type is merely a bakelite disk with a wood handle, and is snapped into side holes in the bell-shaped casting. The second is a combination conveyor hanger and mask for the propeller-shaft hole. The steel hanger has a rabbetted bakelite disk fitted to the lower end. After passing the hanger through the hole, the disk seals the hole from the inside. An exterior seal consists of another disk that is put over the hanger and is fastened in place with a C-washer engaging a notch in the bar.

To stop-off paint from the machined face at the large end of the reduction gear housing, a ring-like mask with expansible elements is employed. One part of this mask is an annular ring

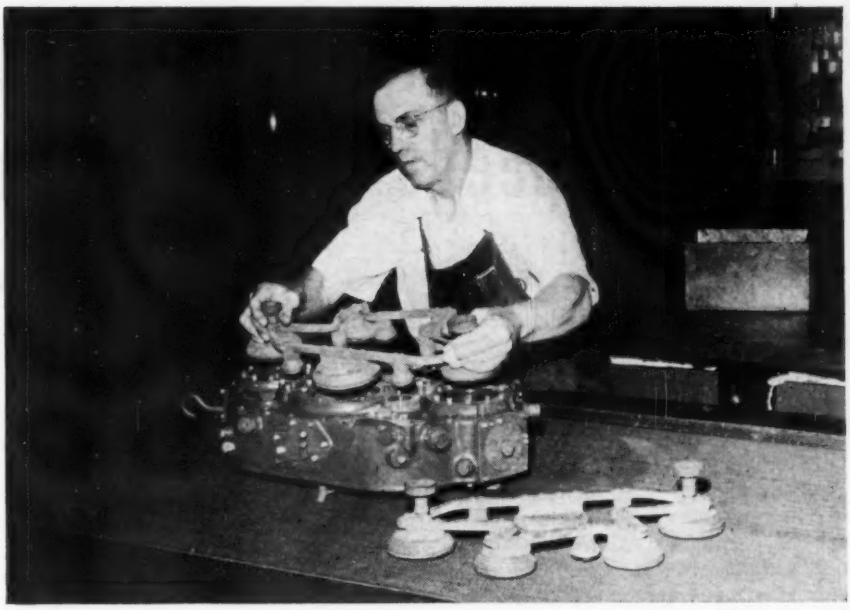
that abuts against the machined flange. Two wedges and two segments are fastened to the annular ring by means of countersunk rivets passing through enlarged holes in the loose elements. A turnbuckle connecting the two wedges is used to expand the segments to grip the bore of the large flange. Width of the mask is such that paint spray will not enter the interior of the reduction gear housing. Obviously, the application of this lower masking plate to the casting is but the work of a few moments and a couple of turns on the turnbuckle.

Multiple masks have been developed to speed assembly time. One of these, devised for sealing holes on one face of the P. & W. blower section, consists of ten disks of various sizes fastened to a common frame. The operator merely picks up the device by the two handles provided and positions it in the holes. This avoids sorting masks of several sizes, and does away with corks for several holes under 3 in. in diameter.

Castings are sprayed at water-wash spray booths, and the masks are removed while the paint is still tacky. The castings are hung on conveyor hangers which are rubber-covered to prevent scratching the parts, and move into the infra-red baking oven.

Masks are cleaned with dichlorethylene at a ventilated spray-washing booth. The masks are dumped into a container with a perforated bottom and are hosed with solvent under high pressure. Cleaning is accomplished in approximately 2 min. Parts self-dry quickly. The solution is filtered and recirculated. The cleaning of masks is a full-time operation for one man, and his health is protected from toxic effects of vaporized spray by an efficient exhaust hood.

Infra-red baking of finishes was developed by the Ford Motor Company, and improvements in equipment from time to time are a natural consequence. In the case of the long tunnel used for baking paint on aircraft-engine castings, the problem was to dispose of heat that ruined the insulation in the base of the infra-red lamps, causing them to short-circuit long before burning out from normal causes. The lamp reflectors are carefully focused to direct the infra-red rays upon the work passing through. The lamp bases are passed through close-fitting holes in a channel when screwed into the sockets. An air space of about 1 in. is left between the legs of the channel and the shell of the tunnel. Air is drawn in through this space and out at the center of the tunnel to keep the lamp bases cool. This arrangement also dissipates excess heat from the working area.



Another of the masks devised by Ford workers is a multiple-type that closes all the large openings on one face of the P. & W. blower section. Corks are inserted in smaller holes

After the center power section of the P. & W. engine is sprayed with paint, the operator removes the masks, puts them in a box for cleaning. Close-fitting durable masks produce a sharp stop-off of paint at machined surfaces. Very little hand taping is now done to avoid sags or runs

Castings reach a temperature of 350 F. in the baking oven. Air-cooling to room temperature, either on conveyors or stacked on skids, would consume approximately 2½ hours for many of the castings. Disadvantages of this method, because of the quantity of production involved, would be: (1) much floor space tied up, (2) dissipation of considerable heat into adjacent working areas, (3) additional chances of damage by contact or sliding during stacking. Ford cools the castings in 23 min. by the use of an air-blast chamber, through which the conveyor winds in a loop. Very little storage area is required to receive cooled parts awaiting transportation to assembly. Heat removed in the cooling chamber is dissipated to the atmosphere, and thus does not throw an extra load upon the air-conditioning equipment installed in the Ford Aircraft Engine Plant.

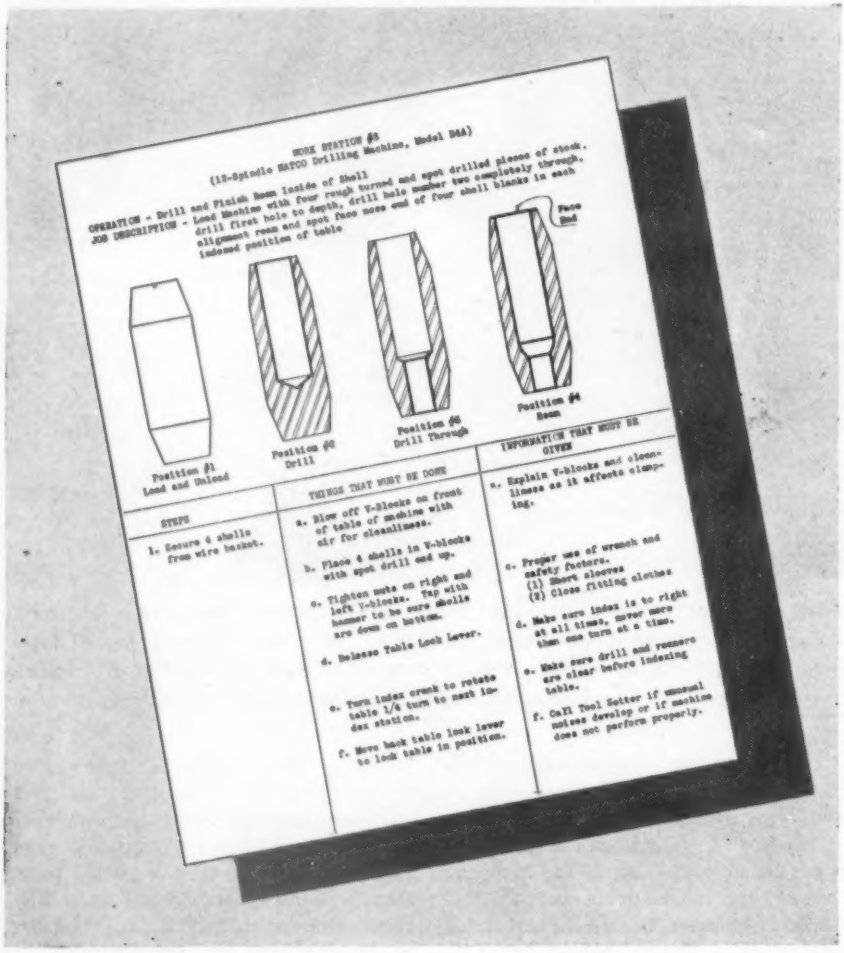
Simplified Training Speeds Shell Production

BY HUGH L. SAMUEL, SPECIAL FIELD REPRESENTATIVE,
APPRENTICE-TRAINING SERVICE, BUREAU OF TRAINING, WAR MANPOWER COMMISSION

WHILE BUILDING its 40-mm. high-explosive shell plant, the Holfast Rubber Company developed a simple and carefully planned training system. Under this program each worker is given a brief preliminary course of instruction and placed on the production line. After that he is trained as he produces. To allow for changes in production demands or working conditions, minor changes in the training schedule are permissible.

Two types of supplementary instruction are utilized before workers are employed on the production line: pre-employment training, including both classroom and shop instruction, and pre-production training, given only in the plant.

Pre-employment instruction has been provided by the Georgia School of Technology. It includes classroom instruction, mainly in shop mathematics, in addition to laboratory instruction in the use of machine tools, the gages and micrometer. Most of the workers completed this course in three weeks. During the final week they were paid 40 cents per hour; immediately upon entering the plant they were advanced to 55 cents per hour, the starting wage paid under the on-the-job training system.


WORK STATION #5
(12-Spindle NATCO Drilling Machine, Model D44)
OPERATION - Drill and Finish Bore Inside of Shell
JOB DESCRIPTION - Load Machine with four rough turned and spot drilled pieces of stock. Drill first hole to depth, drill hole number two completely through, alignment reem and spot face nose end of four shell blanks in each indexed position of table
Face End
Position #1 Load and Unload
Position #2 Drill
Position #3 Drill Through
Position #4 Ream
STEPS
THINGS THAT MUST BE DONE
INFORMATION THAT MUST BE GIVEN
1. Secure 4 shells from wire basket.
a. Blow off V-Blocks on front of table of machine with air for cleanliness.
b. Place 4 shells in V-blocks with spot drill end up.
c. Tighten nuts on right and left V-blocks. Tap with hammer to be sure shells are down on bottom.
d. Release Table Lock Lever.
e. Turn index crank to rotate table 1/4 turn to next index station.
f. Move back table lock lever to lock table in position.
a. Explain V-blocks and cleanliness as it affects clamping.
c. Proper use of wrench and safety factors.
(1) Short sleeves
(2) Close fitting clothes
d. Make sure index is to right at all times, never more than one turn at a time.
e. Make sure drill and reamers are clear before indexing table.
f. Call Tool Setter if unusual noises develop or if machine does not perform properly.

Each operation is analyzed, described in detail and illustrated on sheets which job instructors use as guides, and which workers may study and memorize. Much of the speed and efficiency of the training program is credited to these sheets

After workers are placed on the production line, those who require it are given supplementary classroom instruction in subjects relating to their operations. Whether or not a worker requires additional classroom instruction, either before or after he or she is placed on actual production, is decided in each individual case by the Joint Training Committee after careful consideration of his ability and previous experience.

Before the actual training on the job begins, each new worker is conducted through the plant to give him a general understanding of the various operations and shop procedures. He is advised on safety rules and regulations, company policies and given information which will put him at ease and acclimate him to his new surroundings.

Operation Sheets

The speed and efficiency of the program is due largely to the fact that, wherever practical, each operation has been broken down into a series of the simplest steps, and the work performed in each step set forth clearly and simply on operation sheets. These operation sheets are used as a guide by job instructors who, in most cases, are the production foremen. Workers are given an opportunity to study and memorize these sheets.

There are thirteen operations in all, eleven of which are described in the operation sheets. Practically all opera-

tions are performed on machine tool equipment. In brief, the operations are: 1. Cut off bar stock to length; 2. Rough both ends; 3. Drill to depth; 4. Finish turn outside; 5. Form grind all over (except boat tail); 6. Form tool to cut band groove; 7. Ream and counterbore nose; face and tap nose; 8. Knurl band groove and tap base; 9. Band die; 10. Band forming tool; 11. Marking die; 12. Paint; 13. Pack.

The first column on each operation sheet specifies the steps in the operation. Each step is short and sufficiently simple to be readily understood by a new worker. The second column lists, in the proper order, what has to be done in performing this work. The third column high lights certain information essential for efficient performance and safe practice.

Supplementing these sheets is an operating schedule showing the sequence of shell production operations. This schedule specifies the production requirements in each major operation, the kinds and number of machines used and the number of workers by sex, employed on each machine and operation. The information provided assists the training supervisor in selecting workers best qualified to be trained for any of the jobs in the plant, indicates how many are needed and aids him in coordinating the training and production schedules.

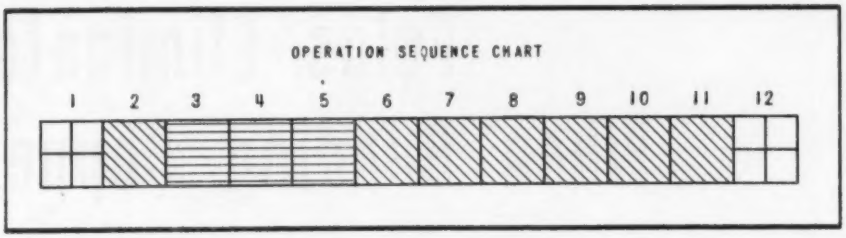
An over-all flow chart of the plant is also used as a guide in coordinating training with production. In planning this coordination, the training supervisor cooperates closely with the supervisor of production.

Starting Operations

Five of the operations—Nos. 11, 9, 6, 7 and 8, in order of simplicity—have been classified as "starting operations." New workers without previous experience are given their initial training in these. Women are trained for all operations except Nos. 1, 2, 3 and 4.

A sequence chart, with similarly marked squares indicating operations requiring approximately the same kind and level of skill, facilitates the moving of workers from one operation to another; this is used to advance them, or to assure maximum utilization of acquired skills, or to replace absentees.

The training supervisor is responsible to the manager of the Ordnance Division of the company for job instruction throughout the plant. It is his responsibility to see that each worker receives adequate instruction and experience, and is advanced in accordance with ability to jobs in which his skill may be fully utilized. Workers in each operation are under the immediate direction of their production foremen.



A sequence chart clearly presents the similarity of skills required for various operations and aids in assignment, shifting and upgrading of workers. For instance, on operation 2 worker may be shifted to 9, 3 to 5 or 1 to 12

In addition to his supervisory duties, the training supervisor interviews all applicants for training, and, in cooperation with a joint management-employee committee, and the personnel department, passes on their qualifications. He also assigns workers to the operations in which they are to start, in accordance with experience, aptitude and ability.

Record sheets on the progress of each worker are posted in plain view of each machine. At the end of each hour the total production of each worker is recorded on these sheets. At the end of each day, these sheets are collected and the records tabulated. The training supervisor makes recommendations, based on these records, to the manager of the Ordnance Division, regarding the advancement of workers.

If a worker shows unusual ability, he may be advanced ahead of the prescribed training schedule. If he shows a lack of ability he may be transferred to an operation requiring less skill than that in which he has been engaged, or he may, subject to review by the Joint Training Committee, be dismissed from service.

A carefully planned training program, with emphasis on simplicity and uniformity, has resulted in green workers acquiring skills that have pushed output above the most optimistic estimates

Wage Scale

The wages of workers are raised progressively as they are advanced from one job to another. Each worker is paid the maximum wage as soon as he reaches the level of production on the work in which he is engaged, whether it takes one week or two months. The production requirements in each step of each operation are specified on the production sheets. The company has adopted a norm of 250 shells per hour, and each worker being trained in each operation is given that rate of production as a goal toward which he advances.

Joint Training Committee

The Joint Training Committee is composed of six members, three appointed by the management, three by the labor union. The committee advises and assists on the selection of applicants and the advancement of those in training, as well as on questions related to morale building. It also irons out any differences of opinion which may arise in connection with training. Workers affected are permitted a hearing before the committee.

The training supervisor serves as consultant to the committee. On major questions the committee may ask a field representative of Apprentice-Training Service, War Manpower Commission, to serve as consultant at conferences. On questions relating to supplementary classroom instruction or employment the committee asks a representative of the school or the U. S. Employment Service to participate at a conference.

Apprenticeship

The short-term training systems adopted by the Holfast Rubber Company to develop workers for semi-skilled jobs on the production line should not be considered in any way as a substitute for apprenticeship. For work requiring all-round skills, apprentices must be trained continuously for an extended period, both on the job and in the classroom.

In addition to the short-term training system, the Holfast Rubber Company has had an apprenticeship system in operation for a number of years in its long established rubber plant. The company participates in the area-wide Atlanta Metal Trades Apprenticeship System which is conducted in conformance with standards recommended by the Federal Committee on Apprenticeship.

Folds Eliminated When Bending Copper Tubes

BY HAROLD HODGES, McCORMICK WORKS, INTERNATIONAL HARVESTER COMPANY

Fig. 1—In this fixture tubes can be bent without restrictions or folds. Those up to 1/2 in. diameter are not filled with sand, and after annealing are bent cold

ONE OF THE CONTRACTS undertaken for the United States Navy by the International Harvester Company requires the production of a large number of different sized copper tubes bent accurately to various shapes and held within close tolerances for length. Most of the tubes have compound or reverse bends which make it impossible to produce them economically on standard tube bending machines. Each tube must be made without restrictions or folds, and is inspected by dropping a steel ball through it. All tubes are inspected for shape on special checking fixtures, and finally are subjected to hydrostatic pressure twice the normal working pressure.

After experimental work, the following procedure was developed for designing and building bending fixtures to suit the various tubes. First, a steel rod of the same outside diameter as the tube is formed accurately by hand to the shape required. After this rod has been studied to determine the sequence for making the different bends, a fixture is built up by welding together steel sections to suit the shape of the bent rod and the finished tube.

Tubing can be bent accurately to shape by drawing it around fixtures instead of pulling or pushing it to match templets. Fixtures are designed to make compound bends without folds

The fixtures shown in Figs. 1, 4 and 5 are typical of those developed in this manner. They are arranged so that one end of the tube is clamped in position, after which it is gradually drawn into shape around the contour of the fixture. Some of the fixtures have sliding blocks or quick-acting clamps that can be moved out of the way while a preliminary bend is being made. Also these movable blocks and clamps make it possible to remove the bent tubes from the fixture at the end of the operation; otherwise, it would be impossible to remove many of the tubes from fixtures because of their complicated shapes. One of the important factors discovered in the development of these bending fixtures was the rule that the minimum inside

radius of the bend should be greater than the outside diameter of the tube if a satisfactory bend without folds is to be made.

Except where the tubes have very thin walls, it usually is possible to bend tubes up to ½ in. diameter without filling them with some material. Further, it has been found that such tubes can easily be bent cold if they previously have been properly annealed, and if proper care is exercised by the tube bender not to force the tube into shape too rapidly.

A typical cold bending fixture is shown in Fig. 1. Here, the tubes already have been fitted with ferrules and coupling nuts, and they have been annealed as shown in Fig. 2. For the annealing operation, a brick-top welding stand is employed to support the tubes while the flame from a specially developed city-gas torch is played over them. While annealing, care must be employed not to over-heat the ends and damage the brazed ferrule joints. The tubes are heated until they become cherry red in color, and then are dipped one at a time in an adjacent tank of cold water.

In bending the tube shown in Fig. 1, one end of the tube is given a preliminary bend in the channel section shown on the fixture plate just above the vise jaw. It is then transferred to the main body of the fixture and carefully wrapped or wiped around the fixture contour. The first end of the tube is located, in both instances, by bringing the coupling nut against stops. A steel plug with an extended handle is fitted into the opposite end of the tube to give the bender a grip on the tube which will not cause distortion. This handle is held in the end of the tube by threading onto it the coupling nut already assembled to the tube.

Thin-walled tubes under ½ in. diameter, and all tubes ½ in. diameter and larger, must be filled with some material to prevent distortion during the bending operation. A number of

Fig. 2—Small tubes that are to be bent cold are annealed by heating with a city-gas torch and then dipping in cold water

Fig. 3—Large tubes are filled with silica sand before bending. One of the plugs that keep the sand in place fits around the end of the tube and prevents distortion as bending pressure is applied

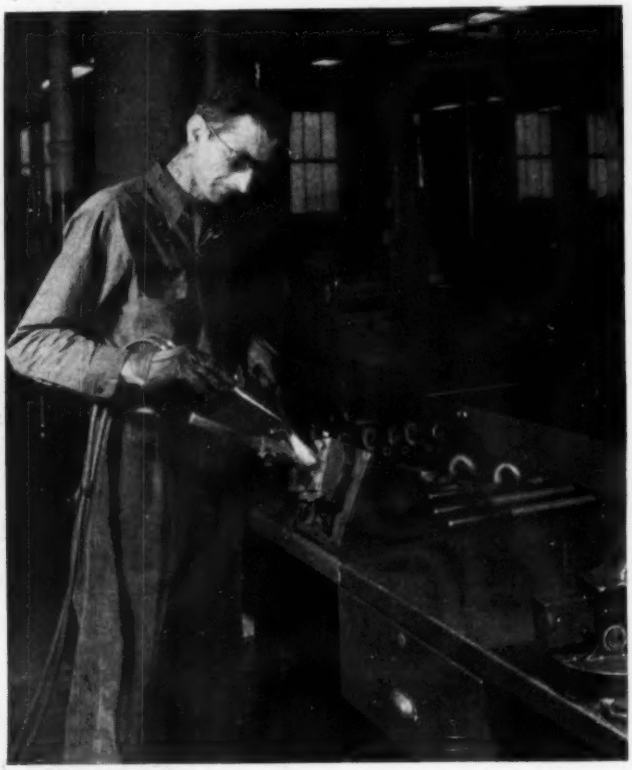


Fig. 4—This ratchet-type fixture is used for bending "pigtail" tubes. They are first filled with sand and heated slowly with an oxyacetylene torch. Bending pressure is applied steadily by the operator

different materials were tried, and the one which has proven most satisfactory for the tubes now being bent is a dry silica sand similar to molding sand used in foundries, but without any of the special treatments sometimes given those sands. Filled tubes are not bent cold. They must be heated during the bending operation to achieve satisfactory results. For this reason, one of the plugs used to retain the sand in the tube has an extended handle which can be gripped by the bender.

As shown in Fig. 3, the tubes are filled with sand by first driving a short plug in one end and then pouring in the sand from the other end. This sand is tamped down by striking the outside of the tube with a wood block. When the tube is filled, the plug with the extended handle is inserted at the other end, driven into position, and then a tapered collar is driven over that end of the tube, so as to compress the tube against the handle. This insures a tight fit of the handle plug in the tube and prevents enlarging the mouth of the tube when pressure is applied for bending.

Figs. 4 and 5 show typical bending operation on tubes more than ½ in. diameter which have been filled with sand. During these operations, the heat, provided by an oxyacetylene torch, must be applied uniformly over the bending area. The heat must not be advanced too rapidly and the tube must be coaxed around the form, not forced into shape. The operator must develop skill to know just how much pressure to apply to produce a desired bend, and then heat the tube slowly with a neutral flame until that bend is made. While the tube is being heated, pressure is applied continuously against the handle in the end of the tube. This causes the tube to bend slowly into shape.

The indexing-type fixture shown in Fig. 4 is for bending a "pigtail" tube of the type shown on the bench in back of the fixture. Also seen on the bench are two tubes ready for bending, and one which has just been bent and still has the plugs in each end. Beside this bent tube is another from which the handles have been removed and the sand emptied into a nearby box.

It will be noted that the fixture shown in Fig. 4 is tilted for the convenience of the operator. As the tube gradually is bent around the center plug, the operator indexes the fixture to keep the unbent portion of the tube in position so that pressure can be applied conveniently on the handle. A spring holds the ratchet lever against the indexing portion of the fixture.

The fixture shown in Fig. 5 is similar in principle to that shown in Fig. 1. However, in this case the tube is larger and must be heated for bending. Fixtures like those shown in Figs. 4 and 5 must be made with relatively thin sections so that the body of the fixture will not carry heat away from the tube so rapidly that the tube cannot be heated to a sufficient temperature to permit easy bending.

Bent Tubes Are Cut to Length

To keep the cost of making these tubes at a minimum, other tube operations in the coppersmith department have been analyzed carefully and time-saving methods developed. Tubes are cut off from mill lengths at a work bench fitted with a bench-type abrasive cut-off machine. A wood guide channel keeps the tube lengths square with cut-off wheel. Stops in this channel permit cutting off tube lengths within plus or minus 1/32 in. Tubes which are to be fitted with ferrules before bending are cut to the finished lengths required. In the case of larger tubes, which are to be bent hot, or where the ends of the tubes are to be threaded after bending, the tubes are made 1-in. or more longer on each end to provide a grip for the bending handles. Such tubes are cut to finished length after bending.

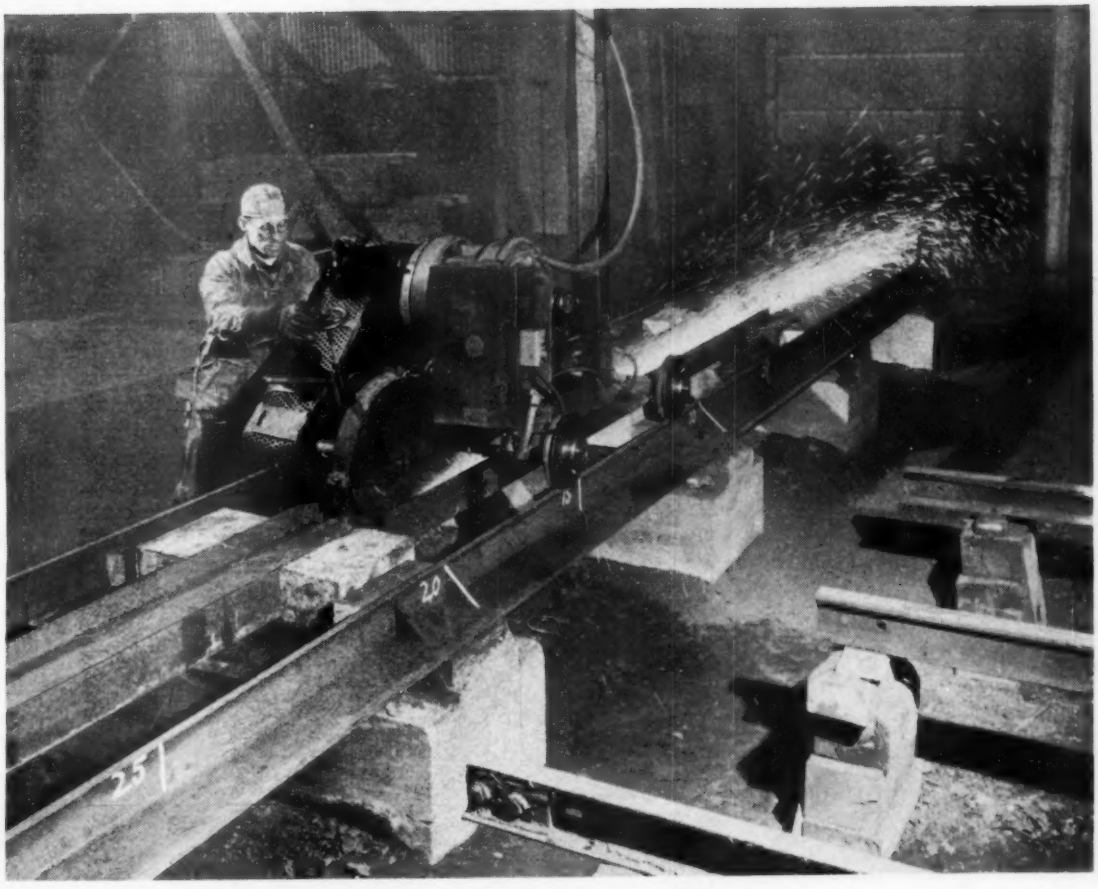
Cut-off tube lengths are burred at each end with three-corner hand scrapers. Then, coupling nuts are assembled on the tubes that are to be fitted with ferrules before bending. When applying ferrules, the tube is gripped in a special vise, a ferrule is located over the tube, and the tube is swedged out to hold the ferrule in place by driving a tapered steel drift into the end of the tube. Location of each ferrule is checked with a gage before the ferrule is brazed in position.

Where monel ferrules are used, induction heating equipment is employed for brazing. However, where brass or copper ferrules are used, the brazing heat is applied with oxyacetylene torches at the special brazing bench in the department. After brazing, the ferrules are turned and faced in lathes, using Stellite tools. The tube is held in a collet chuck, with the extending end of the tube supported on a mandrel held in a tailstock chuck. On most of the tubes, the diameter of the ferrule must be turned within plus 0.000 in. and minus 0.005 in. of the specified diameter, and the face must be square with the tube in order to form a tight seal when the tube is assembled. On some of the larger tubes, the ferrule end must be turned to provide a spherical joint. For these tubes, a special spherical turning unit has been developed for use on a lathe. The cutting tool is swung in arc for this job.

After bending, all tubes are cleaned in a standard bright-dip procedure. Tubes which have been filled with sand for hot bending first are cleaned internally with a steel-wire brush driven by a flexible shaft.

Fig. 5—Toggle clamps are employed frequently for holding a partially bent tube in position in the fixture while other bends are being made. The tube is drawn or wiped around the fixture rather than pushed into shape

Abrasive Wheel Salvages Steel for Ships



A portable abrasive cut-off machine splits I-beams for use as Liberty ship stiffeners

HEAVY I-BEAMS originally rolled for use in bridge construction are being converted for use in Liberty ships. After Pearl Harbor, when ship construction became more important than new bridges, it was found that the steel beams could be employed as stiffeners to be welded to ship bottoms provided that one of the flanges was removed.

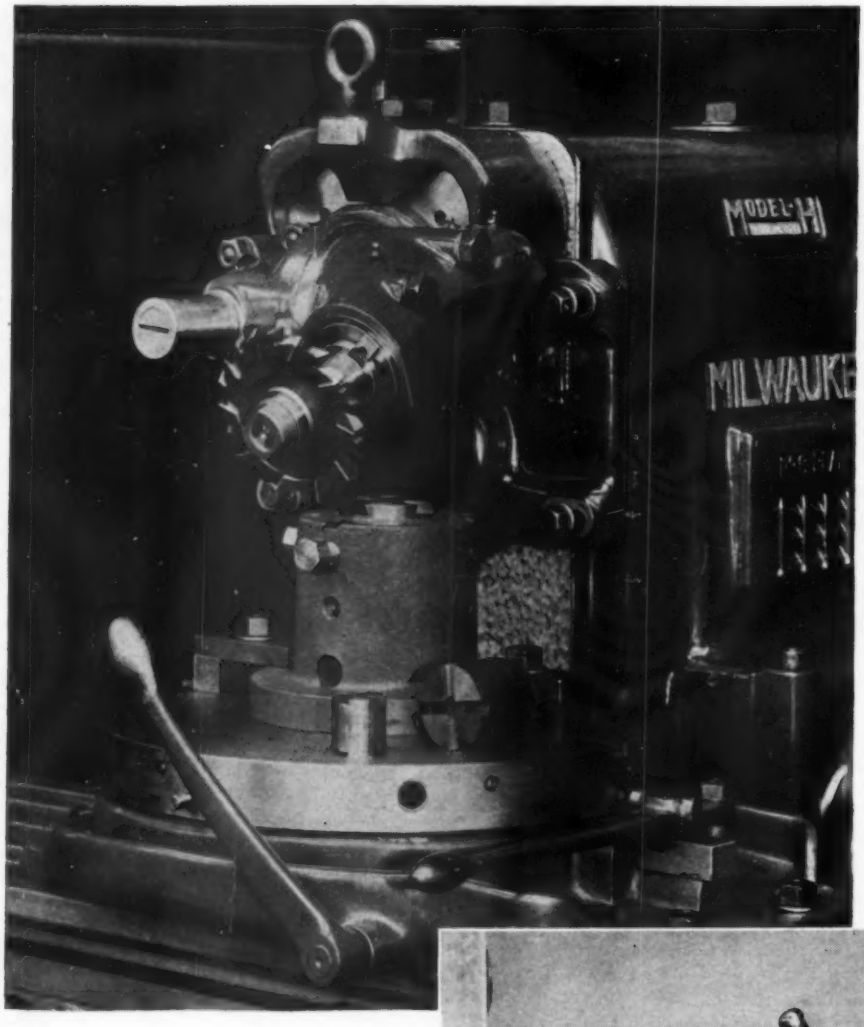
At first this was accomplished by burning off one flange and machining the burned edge. However, an improved method developed by the Phoenix Iron Company, performs both these operations at one time by substituting splitting with an abrasive wheel for burning. An aluminum oxide wheel made by A. P. deSanno & Son is used. The wheel is 16 in. in diameter and 1/8 in. thick; it has a resinoid bond, 46 grit and S hardness.

The cutting edge of the abrasive wheel has a surface speed of 18,000 to 22,000 ft. (approximately four miles) per min. The beams are clamped between two tracks upon which the cutting machine travels. The machine moves at a speed of 100 ft. per min., forward and back the length of the I-beam with the wheel revolving approximately 4,000 r.p.m. and cutting into the steel about 1/32 in. at each path. The tracks are marked with paint to show the beam length in feet.

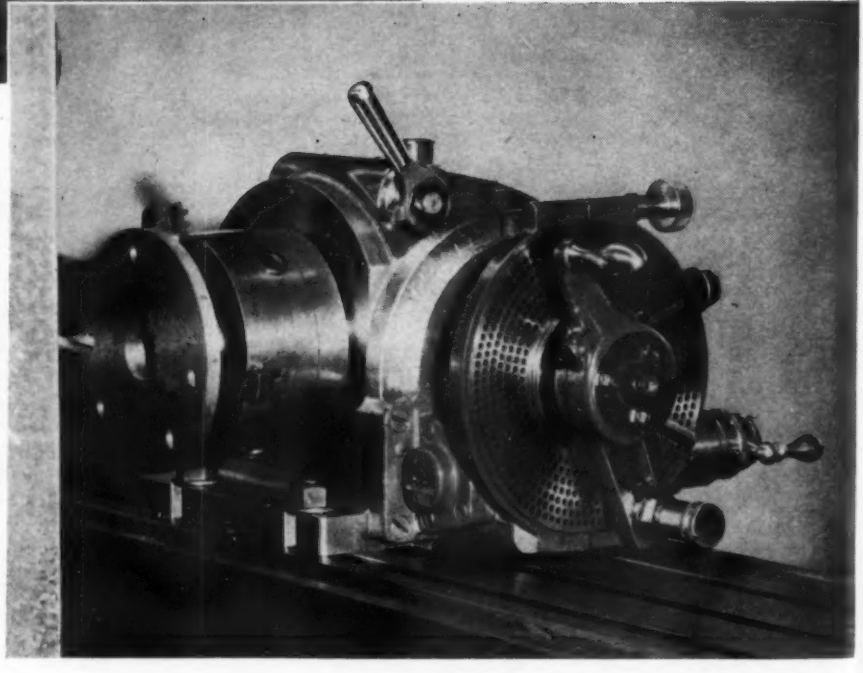
The method can be used to split beams of any length. It has the advantages of giving clean edges, straight and perpendicular to the web, and holding size more accurately. In addition, the equipment is portable and may be used as a standard cut-off machine.

Toolroom Milling — III

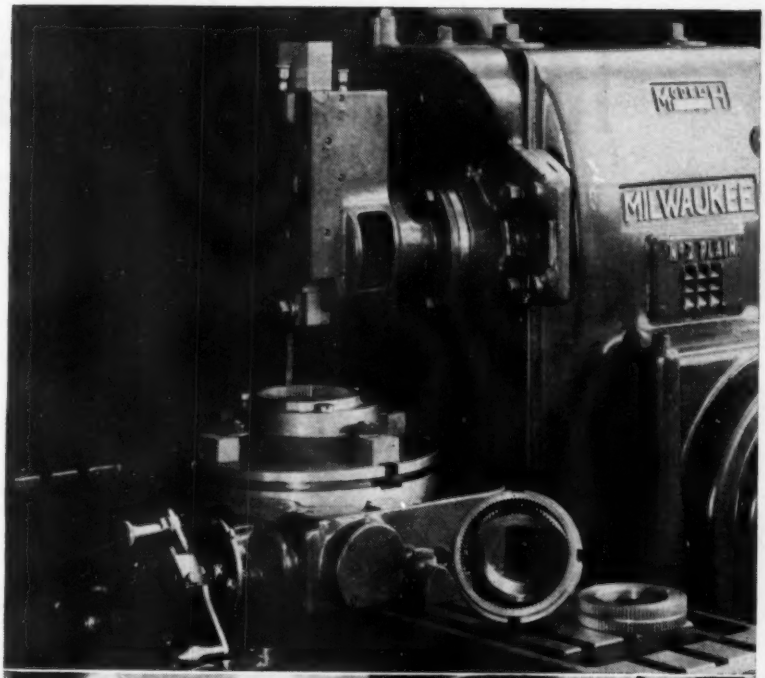
BY H. A. FROMMELT, KEARNEY & TRECKER CORPORATION



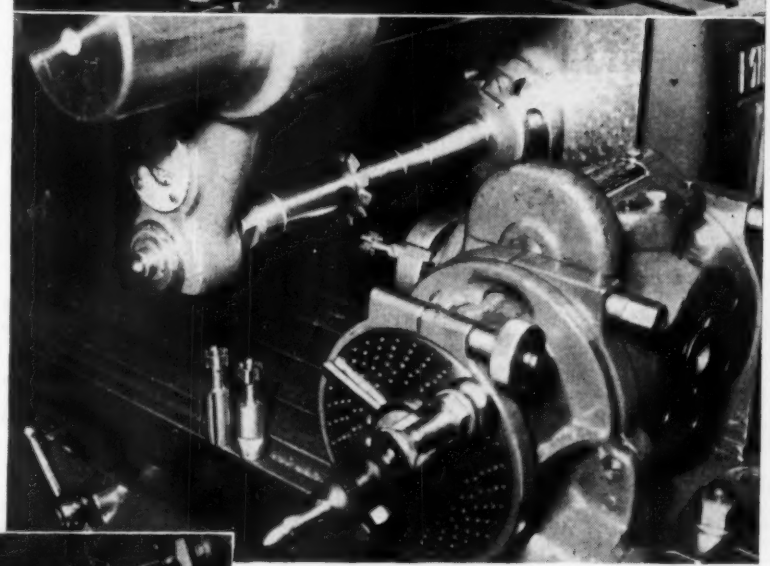
Dovetails in couplings are milled here by holding the workpiece in a hollow cylindrical fixture clamped to a rotary table which can be indexed 90 deg. A universal attachment as part of this set-up locates the cutter and workpiece to the compound angle of the dovetails. A stagger-tooth cutter, rather than a dovetail end mill, is used since more teeth are available to remove metal; also the cutter assembly is more rigid, producing more accurate results. The teeth on the cutter are ground at an angle so that when it is set to cut the sides of the dovetail, the bottom of the slot will be milled flat. The cutter blank is originally machined to this angle—then the teeth are milled and ground



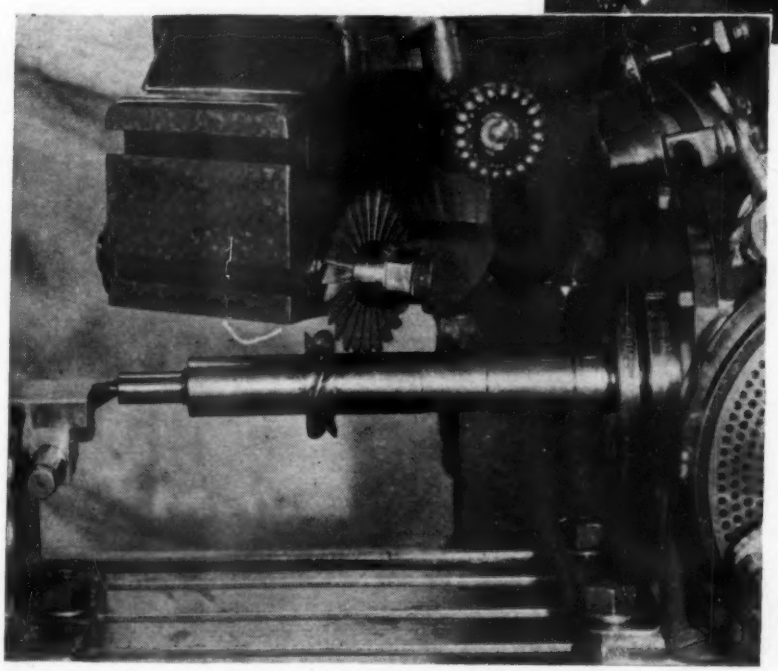
Jig plates to be drilled, bored and reamed are set up as shown here. This particular job has five holes spaced according to specifications plus or minus 30 sec. on a circle of 6 in. diameter plus or minus 0.001 in. When setting up the job, an indicator is mounted in the machine spindle and the plate is first indicated for trueness in the chuck. Then it is checked for concentricity with the spindle by indicating the outside diameter and moving the table until the indicator reads zero around the circumference of the plate. The table is then moved until the spindle aligns with the hole circle on the plate, preparatory to drilling and reaming the holes



Internal serrations machined on the locknut shown in this illustration is a typical job performed on a standard horizontal milling machine equipped with a slotting attachment and a rotary table. The latter in turn is equipped with an index plate. The forming or serrating tool is ground with a 90-deg. point angle. The rotary table worm and worm wheel has a ratio of 1 to 100; therefore, if the number of serrations is 100, one turn of the crank will index the workpiece for locating each of the successive cuts

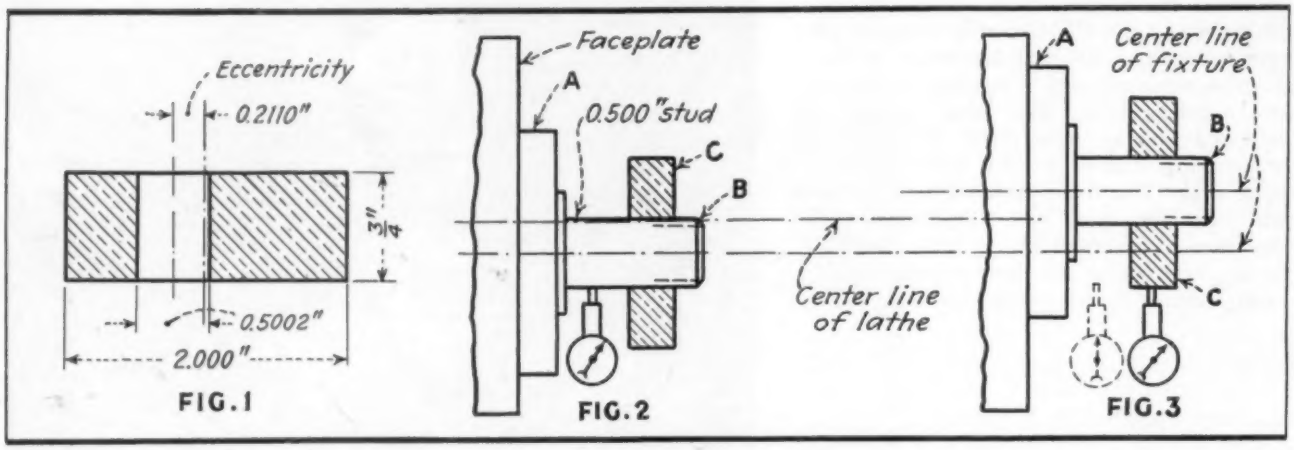


T-slot milling cutters can be machined by holding the blank in the faceplate of a dividing head. The cutter being milled here is of the staggered-tooth type, has six right-hand teeth, and is set up for machining a clearance on the teeth. The cutter was slotted in a previous operation, thus making the operation of milling the clearance in each tooth more economical. The cutter is set up as shown and indicated to the cutter for machining its clearance. Clearance on each successive tooth is milled by indexing the cutter 60 deg. The third and final operation consists in backing off the sides of the cutter teeth, using a small Woodruff cutter



Fly cutters can be machined on a horizontal milling machine equipped with a thread milling attachment. The cutter blank is mounted on an arbor held between a dividing head and tailstock. The cutter being milled in this set-up has five teeth, a diameter of 2½ in., a bore of ¾ in., and a lead of 2½ in. Reference to a handbook resulted in the selection of the following gears for differential indexing: a 25-tooth gear on the dividing head shaft, a 20-tooth inner gear on the stud, a 21-tooth outer gear on the stud, a 28-tooth gear on the hand directional shaft, an 8-tooth worm on the upper shaft, and a 24-tooth worm on the lower shaft. The workpiece is indexed for five teeth by turning the index crank one turn on the index plate, since the spiral dividing head used here has a five-to-one gear ratio. The 3½-in. form cutter used for milling is run at 55 r.p.m. giving a surface cutting speed of 60 ft. per min. The feed rate is 2 in. per minute

Ideas From Practical Men



This method of indicating eccentric work can be used when the eccentricity is beyond the range of the indicator

Indicator Locates Eccentric Work

BY WALTER JAKES

The toolmaker is often called upon to turn eccentric work in the lathe. As a rule, it is possible to set up these jobs with an ordinary type of dial indicator. However, if the amount of eccentricity is large, and it has to be held to close tolerances, the ordinary indicator is not suitable because it lacks either range or accuracy, or both. To handle such eccentric jobs without special or expensive equipment, the following method has proved useful.

Make a special bushing, using the following formula:

$$O.D. = I.D. + 4E$$

where O.D. is the outside diameter, I.D. is the inside diameter, and E is the amount of eccentricity desired on the workpiece to be machined. This bushing is slipped over some portion of the work or work fixture which has been turned concentric. The work, which is probably held on a faceplate, is moved by scale to its approximate eccentric position. Then the work is indicated so that the low spot on the special bushing and the high spot on the concentric portion of the work or work fixture on which the bushing is seated are an equal distance from the center of the lathe spindle. Thus the work can be indicated with a short range indicator to its proper eccentricity. If the indicator reads to ten-thousandths of an inch, any desired degree of accuracy can be obtained. Following is a typical application of the method.

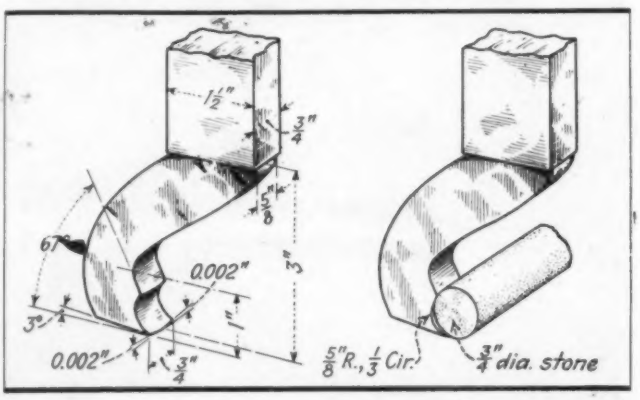
A number of bushings shown in Fig. 1 have been machined all over, drilled and reamed, and must be turned eccentric to the hole. Fixture *A*, shown in Figs. 2 and 3, with stud *B* for holding the bushings, is mounted on the lathe faceplate and has to be set up accurately to the proper eccentricity. Special bushing *C* is made for indicating purposes, using the formula to determine the outside diameter, which is $0.500 + 4(0.2110)$ or 1.3440 in. The bore of the bushing fits snugly on stud *B*. The width of the bushing is small to leave room for the indicator to touch the stud.

The fixture is set over on the faceplate to its approximate eccentric position, and is then indicated. When both the high spot on the stud, Fig. 2, and the low spot on the bushing, Fig. 3, reads zero on the indicator, the fixture and the bushings to be turned thereon will be exactly 0.2110 in. eccentric. On small work it is advisable to use an indicator with a small point to avoid interference when indicating the low spot of the bushing

Scraping Eliminated by Machining Smooth Surfaces

BY RALPH R. WAECH

It is often desirable to finish machine a steel surface so smooth that little or no scraping is required as a subsequent operation. This can be done with the illustrated tool, which produces a thin sheared chip. It is made from a standard flanged gooseneck tool with the cutting edge behind the clamping face, and has a concave area ground to a 5/8 in. radius directly behind the cutting edge. The latter must be parallel with the face of the tool, and for best results this edge and the end of the tool should be honed. The tool is 3/4 in. wide, but the ends of the cutting edge are



This tool will take 0.002 in. cuts on steel parts, producing a surface that requires little or no scraping prior to final fitting and assembly

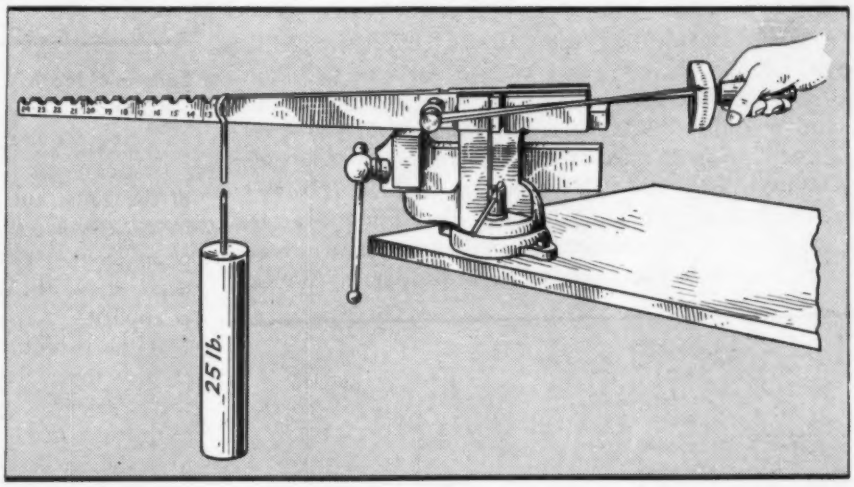
relieved a minimum of 0.002 in., making it possible to take a flash cut ⅝ in. wide. When sharpening this tool, the cutting edge should face the side of the grinding wheel in order to leave a straight edge for honing.

This tool will take a cut of 0.010 in. on a rough machined surface. Final finishing cuts should not exceed 0.002 in. It is advisable to chamfer the work at the point where the tool first makes contact, to chip open any sand holes in the work, and to remove chips from ahead of the tool during the cut. Although the use of the tool requires care, this is offset by the time saved in scraping and fitting the finished surface.

Scale Checks Torque Wrenches

BY S. C. SPINK
Westinghouse Electric & Manufacturing Company

In the last few years, torque wrenches have come into wide use in assembly work for tightening nuts and bolts to a predetermined load. Even though these wrenches, like other calibrated tools, need to be checked for accuracy from time to time, many shops have no equipment for doing this work. Such shops will find the illustrated device quite suitable. It consists of a lever 2 ft. long with notches spaced 1 in. apart, starting at the middle of the arm. Each notch is numbered from 12 to 24 indicating its distance from the fulcrum which is the point where the wrench is applied to the lever.



This balanced lever can be used for checking the accuracy of torque wrenches within a range of 25 to 250 ft.-lb. Other weights can be applied for larger wrenches

The lever is balanced at the point where the torque wrench engages a nut welded to the lever. The lever is drilled and tapped with the same thread as the nut, thereby allowing a bolt, approximately 4 in. long and threaded at one end, to be screwed loosely into the lever and nut. The unthreaded end of the bolt is then clamped in a vise while the threaded end becomes a rigid fulcrum for the lever. This device can be used by relatively non-technical operators since the weight can be adjusted from notch to notch in the lever until the applied torque falls within the scale on the wrench.

Gaging Fixture Checks Bolt Recess

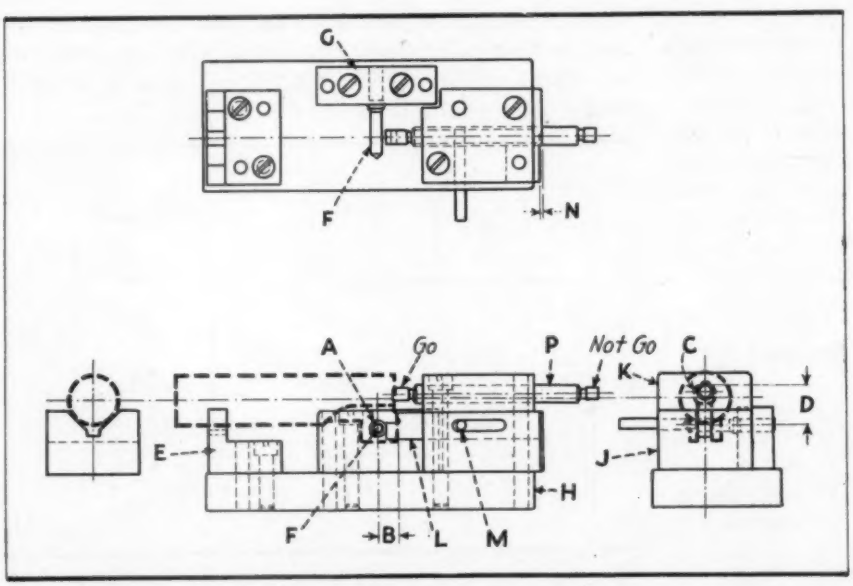
BY F. SCRIBER

When inspecting the part shown by heavy dashed lines in the drawing, we had to check the distance from hole *A* to the end of the piece as indicated by dimension *B*. The position of circular recess *C* relative to hole *A*, as indicated by dimension *D*, also had to be checked. The illustrated fixture was designed for such inspection.

The work is centered in V-block *E* after first slipping it over pin *F* which enters hole *A* in the work. Pin *F* is mounted in block *G* held by screws and dowel pins to baseplate *H*. The baseplate also carries V-block *E*, as well as block *J* and its cap *K* that holds the gaging pin and slide bar.

After the work is placed on the pin and V-block, slide bar *L* is brought forward to the position shown in the drawing by means of pin *M*, which was at the right-hand end of the slot while putting the work in place. This slide bar has the double function of entering the slot between the two lugs on the work, thus centering that end of the work on the pin, and at the same time gages distance *B* to a plus or minus limit. The inspector takes a reading at step *N* on the end of the block to see if the end of the pin is between this step while the slide bar is held against the work.

With everything in the position shown in the drawing, the position of the recess at dimension *D* is checked.



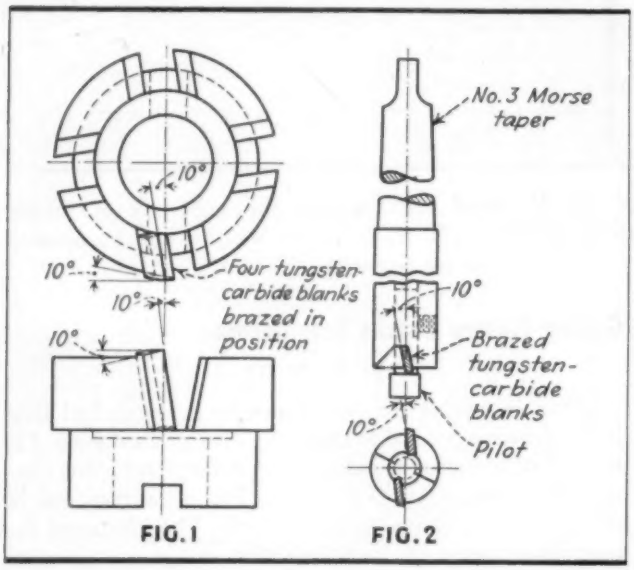
This fixture checks both the size of a recess and the location of the recess from the end of the bolt

This is accomplished by gaging pin *P*, the "Go" and "Not Go" ends of which are tried alternately in the recess. The gage is used to check hundreds of parts daily.

Milling Cutters That Increased Production

BY KENNETH L. FORD

After experimenting with various cutters for milling steel weldments, we designed the 4-in. shell end mill shown in Fig. 1, which has a carbon steel body and four standard tungsten-carbide blanks brazed in position. It is used on a 2½-in. boring mill for face and plain milling operations. Cutting speed is 400 r.p.m., while the feed rate is based on a chip load of 0.006 in. per tooth. Since using this cutter, production of finish-machined weldments has increased from three to twelve pieces per eight-hour shift. We have



These shop-made cutters with carbon steel bodies and tungsten-carbide inserts overcame a tool shortage and resulted in faster production

varied the size of this cutter, increasing the number of teeth when necessary, to perform operations on all types of milling machines.

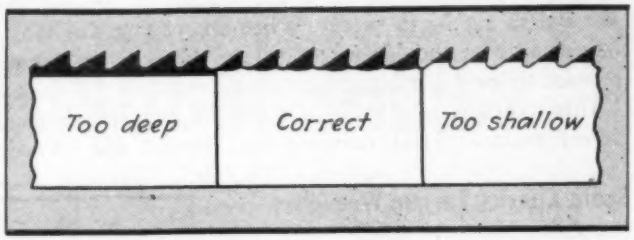
Fig. 2 shows a tool designed to spotface steel castings. Like the shell end mill, it has a carbon steel body with standard tungsten-carbide blanks brazed in position. Running at 1,800 r.p.m., this tool has spotfaced as many as 400 castings before resharpening was necessary. Its use has increased by 100 percent the production of spotfaced castings.

Extends Bandsaw Life When Cutting Contours

BY H. J. CHAMBERLAND

Most hardened bandsaws will perform satisfactorily on straight cuts. However, when some of these saws are subjected to the strain of side pressure incurred with contour sawing, some strip a tooth here and there, while others rapidly lose their set. These difficulties can be overcome by hardening the teeth to the proper depth.

The correct tooth hardness for a bandsaw intended to cut curves and radii seems to be one that extends to the bottom



Bandsaw teeth hardened to the bottom of the gullet will bend slightly when side pressure is applied, increasing the life of the saw when cutting contours

of the gullet but not beyond. Teeth so hardened seem to have the correct amount of flexibility at a very essential point of the band. At this particular location, hardness depth allows the teeth to move minutely when side pressure is applied.

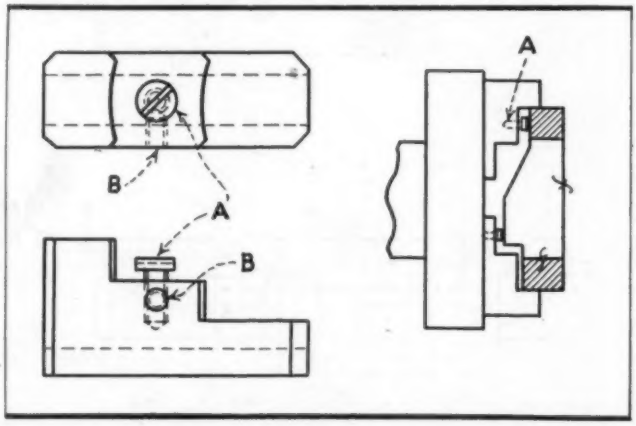
If the hardness line is too deep, the teeth cannot bend even at the gullet, and it follows that they will break at their weakest point sooner or later. If the hardness of the teeth is not deep enough, the side pressure will cause them to straighten out or rapidly lose their set due to flexing incorrectly. Incidently, correct hardness depth by itself will not entirely solve the problem of extended saw life, since it is only a part of a differential heat-treating technique.

Chuck With Locating Screws Speeds Set-Ups

BY EARL J. BREEDING

On small-order chucking jobs, where the cost of special fixtures is prohibitive, rough castings can be easily aligned in the chuck by used locating screws placed directly in the movable jaws at the necessary positions. The jaws are drilled and tapped for screw *A*, which is held in position by setscrew *B* at right angles to screw *A*. These screws also prove useful as a spacer on boring jobs where the diameter of the bore exceeds the closed limit of the jaw stops and clearance for tools is needed.

The screws can be removed and laid aside when the chuck is needed for ordinary jobs. Any number may be used as long as the jaws are not weakened too much by subsequent drilling. The tapped holes can also be used for the addition of soft jaws to the chuck.



Holes can be drilled and tapped in chuck jaws to take screws that serve as locating points when chucking rough castings ordered in small lots

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Armament

Republic's Spider Line Applies New Methods

Outside contour of the locking plates is roughed milled, and later finish milled, four at a time by a multiple-spindle profiler. The operation is controlled by the master cam at right

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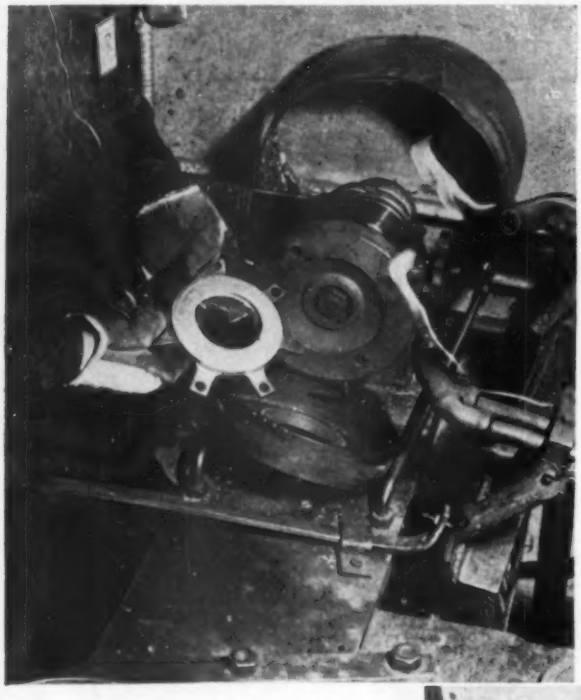
As part of a program that tripled plant output, Republic Aircraft Parts tooled up the "spider line" to utilize equipment which not only holds close limits for dimensions and surface finish but is also highly productive

IN A RECENT twelve-month period, Republic Aircraft Products Division of The Aviation Corporation increased its monthly output of precision engine parts by over 200 percent. This was not the normal step-up of a newly launched enterprise. This division, comprising two plants in Detroit, had been devoted exclusively to aircraft engine parts for eight years. Obviously, increased efficiency accounted for the improvement. Basis for the step-up was an analytical study of each part to evolve speedier shop practices.



A counter-bored locking plate is clamped in the babbitting fixture and spun while molten metal is poured. Gas torches preheat the babbitting fixture

Representative of such a step-up is the so-called "spider line," developed for fast production of knuckle-pin locking plates for air-cooled radial aircraft engines. These plates fit over the front or rear main crankpin, and are bolted to the ends of the knuckle-pins to keep them from turning. They have splines that mate with the splined ends of the master-rod bearing shell to prevent it from turning in the rod.

The opposite face of the locking plate is of mirror-finished babbitt, to provide a thrust bearing for the rod. An oil passage through the spider fingers conveys lubricant to the knuckle pins. Thus, quantity production of these locking plates posed several problems, because of the surface finish required and the delicacy of their structure.

But this is how these problems were solved:

At the outset, the locking plates are steel forgings with a contour consisting of three pairs of spider fingers, with a space in the position of a seventh, and four concentric inside diameters.

First, the minor inside diameter is qualified, holding it to a tolerance of 0.001 in. This provides location for rough milling the outside contour, four blanks

Three stages in locking plate production. At left, the rough forging. Center, after a rough cut has been taken on all surfaces (except the outside contour), and the web formed. At right, finished part

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When drilling three oil holes in each spider finger, a hand-operated fixture is positioned in the counterbore to hold the 3/32 in. drill during the start of each hole. After each of the three holes has been well started, the fixture is snapped out of place

On this multiple-spindle drill, the locking plates are clamped into position under the fixture plate held by the operator. In a continuous operation, the six spider fingers are bored, counter bored and reamed to fit over the knuckle pins

at a time, on a four-spindle vertical profiler. The minor inside diameter is also used for location in grinding the major inside diameter to within 0.005-.006 in. of finished size. Leaving 0.005-0.006 in. of stock on the major inside diameter, which becomes an oil seal when the plate is slipped over the crankpin, means an additional operation at the end of the production line. This extra operation is actually advantageous because it takes care of all scratches resulting from handling the piece in several intervening steps.

In performing this operation, the usual disappearing adapter was unsatisfactory due to delicacy of the part, which distorted under pressure, throwing the bore from 0.003-0.005 in. out of round. Instead, a fixed locating pilot is used, with air chuck fingers applying just enough pressure to hold the part secure.

The completion of this operation leaves both the major inside diameter and the minor inside diameter concentric to within 0.001 in., qualifying them to be used alternatively for locating the subsequent operations and particularly for machining both faces.

The next step is to grind the face of the web, which exists between the first and third inside diameters and eventually becomes a spline, parallel to the back face to within 0.002 in. To hold this tolerance, the adapter is trued to 0.001 in. Then the face of the fingers is ground on a rotary grinder until it is parallel with the web face to within 0.002 in.

With all locating diameters and surfaces qualified, a complete paddle gage inspection is made. A diameter indicator is used, and dimensions are read to 0.0005 in.

Preparation of Part for Babbitting

Next, a babbitt bearing surface must be applied. Before this can be done, the workpieces are degreased, then placed in an infra-red oven to raise them to 350 F. Thus warmed, the plates can absorb a protective coating of solution, applied by dipping, to prevent adherence of babbitt to the plate except where desired. Then the piece is counterbored on a lathe to within 0.060-0.070 in. of the back face of the slot to provide clean metal for the babbitt. Following this, the plate is masked and a flux applied to surfaces of the counterbore, so that it may be dipped in molten tin, which adheres thinly to the counterbored area.

The prepared plate is mounted on a spinner and

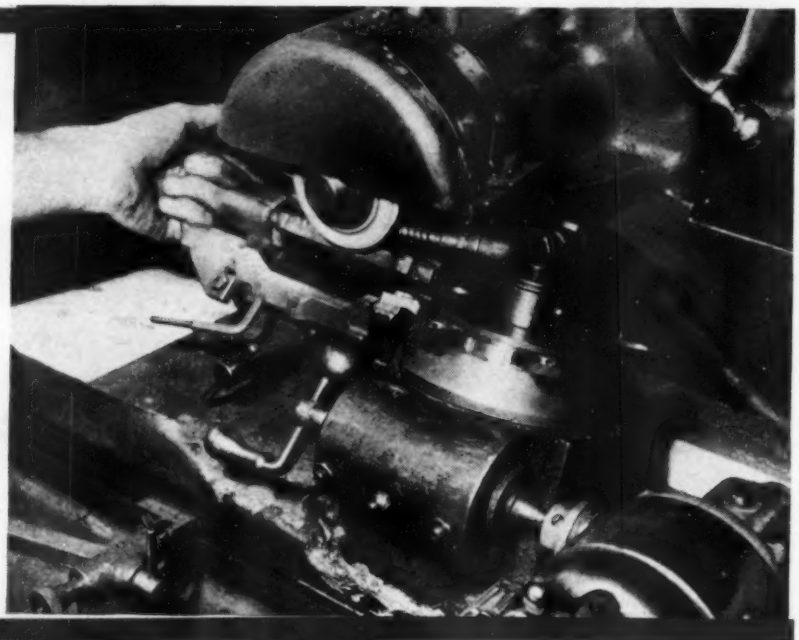
the centrifugal babbitting fixture is clamped in place. With twin-gas torches pre-heating the part, the babbitt is poured. A nick, made in the rim of the counterbore with a knife-blade file, relieves an otherwise air-bound condition during the pouring. Nevertheless, 33⅓ percent more pouring volume was achieved by boring out the fixture. This permits slower cooling and allows the bubbles to accumulate on the face side of the babbitt, where pits left by the bubbles are in excess metal.

When the part is removed from the spinner and cooled, the back angles of the fingers are sand blasted to remove coating and babbitt spatters, before grinding. This is necessary since small particles of babbitt tend to build up on the grinder and eventually throw the plate out of the fixture.

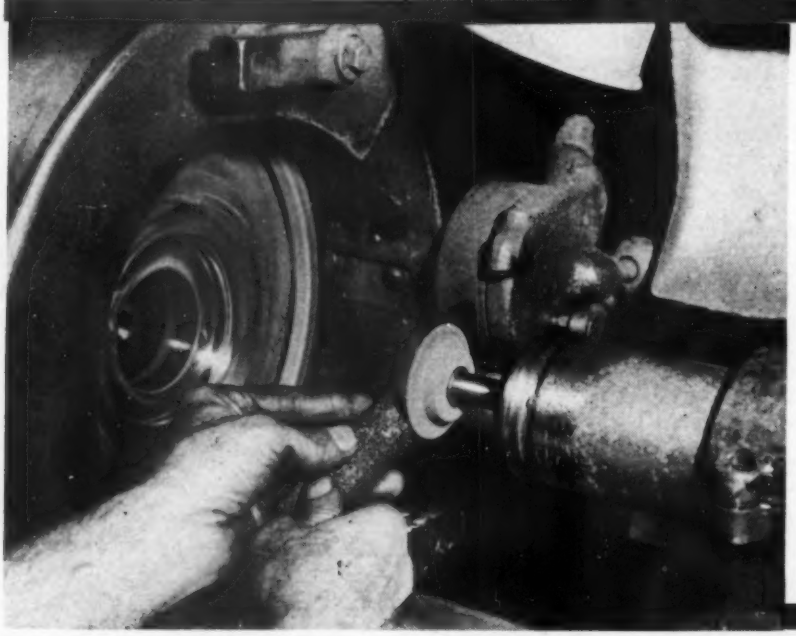
The web and major inside diameter are polished with emery cloth to provide a clean surface for the locating adapter that positions the plate for machining the babbitt face and the minor inside diameter. While machining removes excess metal in which the dross and minor surface imperfections have accumulated, it leaves sufficient stock to permit removal of mars and scratches occurring during subsequent operations.

Then the back angles of the fingers are ground off, thickness being held to 0.001 in. tolerance, and the minor inside diameter is ground down to 0.0005 in. tolerance, so that both the babbitt and steel comprising it are revealed as juxtaposed bands.

A multiple type drill is used to bore, counterbore and ream the six spider fingers to fit over, and be



Surface of the grinding wheel used to finish the undercut on the plate face at the base of the spider fingers is maintained in proper contour by use of special form dressers. A diamond nib mounted at the center of each bar of the dressing fixture is raised to contact the edge of the grinding wheel. Arc of the bar's movement is arranged to effect the desired difference in contour on each side of the wheel



Desired finish of the back face is accomplished with a spindle-mounted abrasive wheel, which is dressed by skilled use of a stone

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fastened on to the milled-off ends of the knuckle pins.

The outside contour is then finish milled to tolerance of 0.010, the plates being handled four at a time on the same type of profiler on which the first production step was performed. A second drilling operation provides three 3/32-in. oil holes at an angle of 22 deg. in each finger, leading from the countersunk knuckle pin hole to the inside diameter between the web and oil seal.

To hold the holes to close tolerance and to prevent drill breakage, a special, hardened drill fixture, which clamps into the counterbored hole in the spider finger, is used to start the drill on the curvature of the counterbore. After the holes are sunk to about one-third depth, the drill is withdrawn and the fixture snapped out of position, carrying with it all chips. This eliminates yet another cause of binding and breakage. Then the outside contour is ground and polished, removing mill marks and leaving a smooth finish.

Special Dresser for Grinding Groove

An undercut on the plate face, at the base of the fingers, is roughed out on a screw machine and then brought down 0.030 in. more on a surface grinder, to give it finish and remove all lines and marks that might institute a break. Grinding of this groove is accomplished by use of a special form dresser, which gives proper contour to the surface of the cutting wheel. Rotary grinding follows to finish the face to a tolerance of 0.005 in. and the back to 0.002 in.

Each of the three pairs of spider fingers are of different lengths, and their ends must be at right angles to their radii. To true these fingers, a cam with different pairs of radii is used to control the grinder, which squares off the rounded ends and holds the required length of each finger, measured from a common center, to a tolerance of 0.004 in. as checked with a feeler gage. Thereafter, all edges throughout the locking plate are broken with a file.

The minor diameter is ued to locate the plate for cutting spline teeth in the web on a gear shaper. The spline must be concentric with the oil seal hole to within 0.002 in. Edges of the teeth are broken with air spindle equipment, in bench operations. All marks are removed from teeth and the general plate contour by hair brushing.

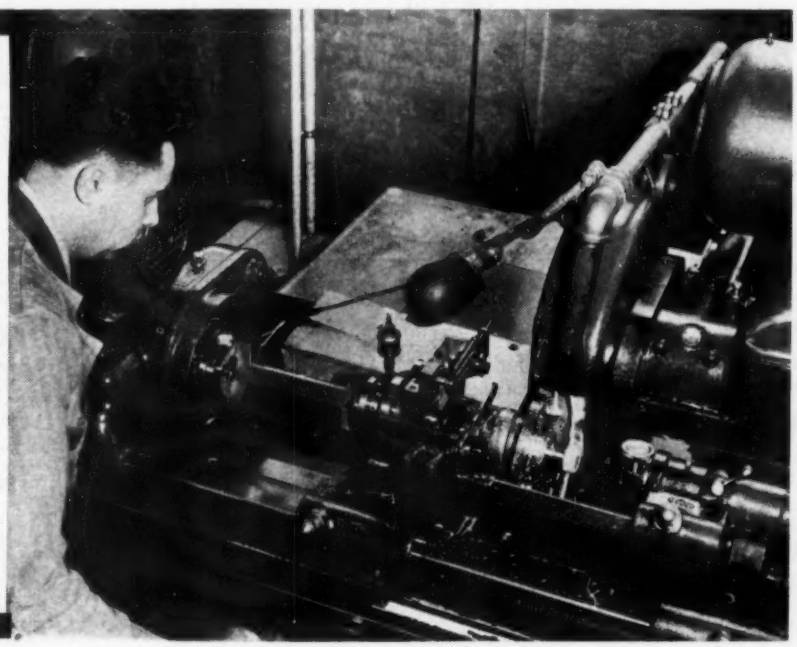
A surface finish of 16 micro-inches, or better, is given the back face by a special operation. This includes the use of an abrasive wheel, which is dressed to thickness of 0.100 with a hand carborundum stone. The work bed and spindle are closely aligned so that the side of the abrasive wheel comes in contact with the back face at all points.

Final inspection of all finished dimensions follows. A plug gage is used to check the oil seal hole for size. Its roundness is read on an indicator gage, graduated in 0.0001 in. The spline and spider fingers are inspected with a special fixture gage.

After grinding, the piece is allowed to idle and "spark out" for 60 to 90 sec., which produces what may be called a glazed finish.

A cone-shaped grinding wheel was tried, which cut faster but did not give the desired finish because only a limited cutting surface was in contact with the face at one time. This made polishing necessary, which was exceedingly difficult by reason of the construction of the locking plate.

Reducing the babbitt surfaces to final dimensions



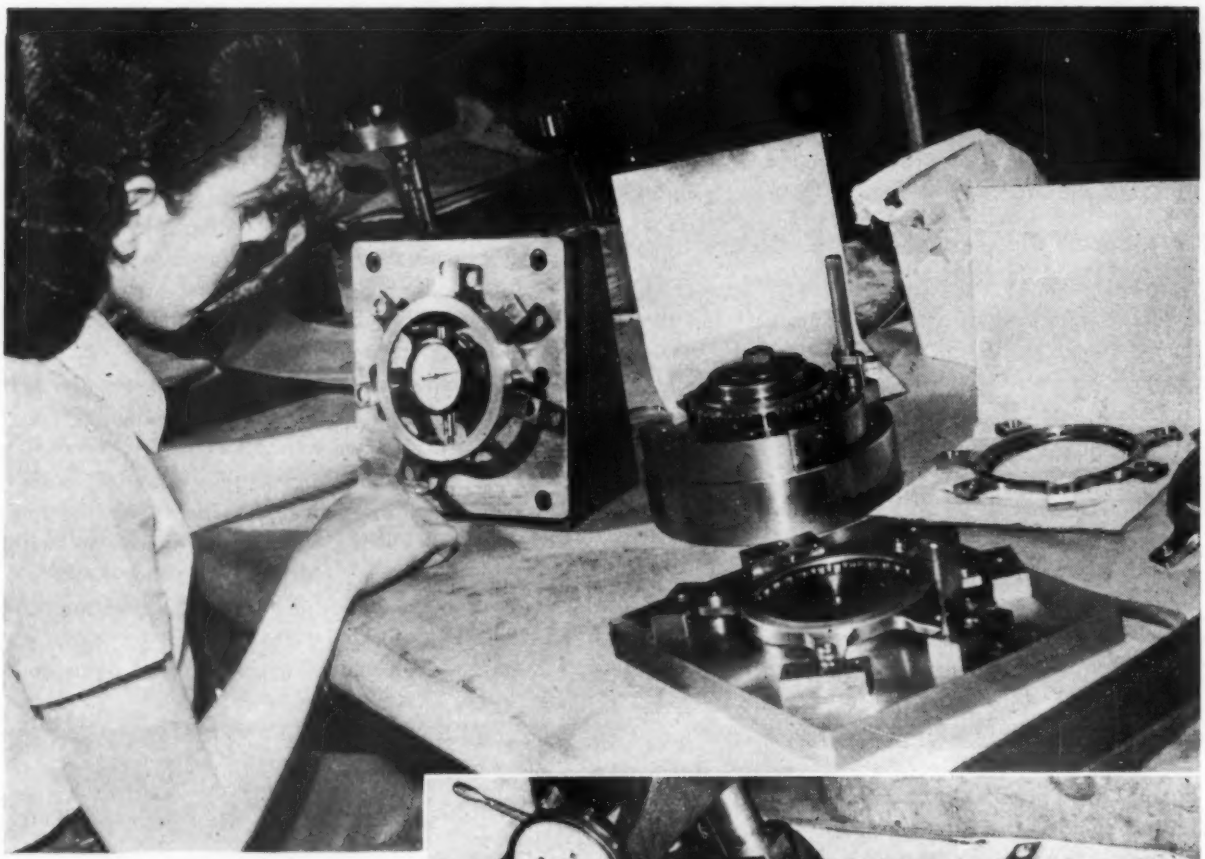
Equipped with special cam-actuated spindle, this grinder finishes each of the locking plate's three pairs of fingers to their respective lengths and squares up the ends precisely at right angles to their radii. The cam, seen immediately at right of the oil cup and just inside the universal joint of the drive shaft, is contoured to nullify the arc through which the fingers would normally be rotated as the end of each is ground. This produces a square end instead of the the round one which would otherwise result

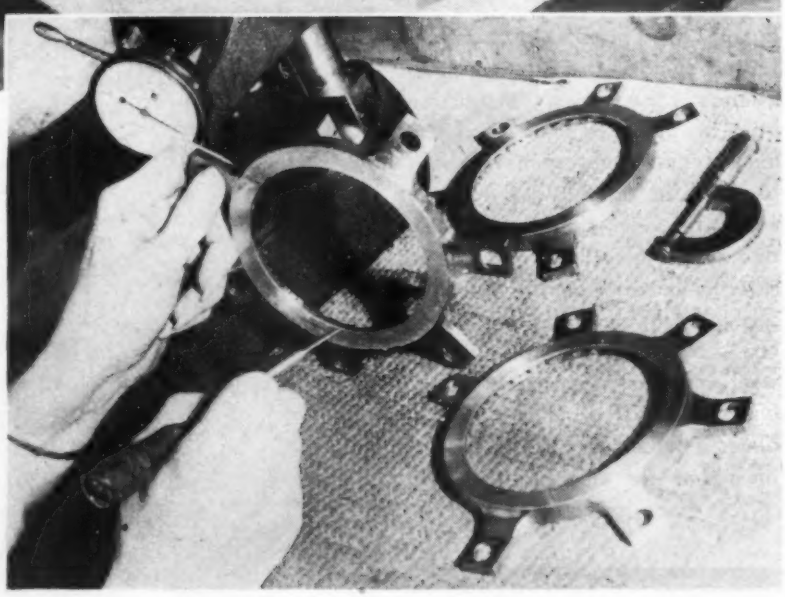
is left until the last operation, since no repair is possible should their finish be scratched or marred during the previous inspection sequence.

In a lathe, the babbitt is machined to exact over-all dimension, a tolerance of 0.002 in. from the face of the fingers to the babbitt face being allowed. A trim of 0.030 in. is turned off the outside diameter of the babbitt, which removes the rim of the counterbore into which it was poured, and leaves a continuous babbitt bearing surface.

Inspection is accomplished by boiling the plates in oil, which raises them to a temperature of from 280 to 300 F. to allow the thin lubricant to seep into any imperceptible separation between the babbitt and steel. The oil is then wiped off and pressure is applied against the face. Any resulting seepage from the bond gives visible proof of imperfection.

Thus finished, the knuckle-pin locking plates are placed in partitioned containers for protection while being conveyed to the shipping department. There they are packed like watch crystals and shipped to the prime contractor.





Roundness of the oil seal hole in each locking plate is checked with a dial indicator, the part being mounted on the fixture so that it can be rotated around the gage. Inspection fixture at center is used to check accuracy of spline teeth. The one in the foreground is used to determine accuracy of the finished spider fingers

Bond between the steel and babbitt is revealed after the minor inside diameter is ground to a 0.0005 in. tolerance

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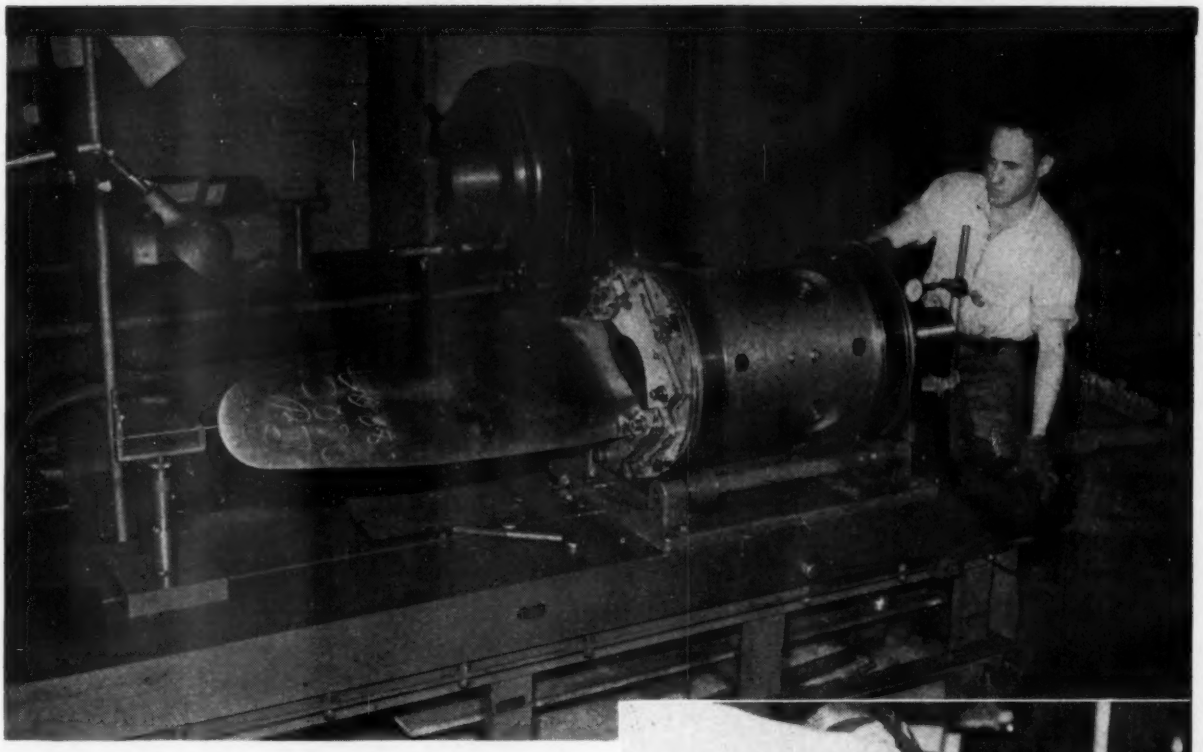
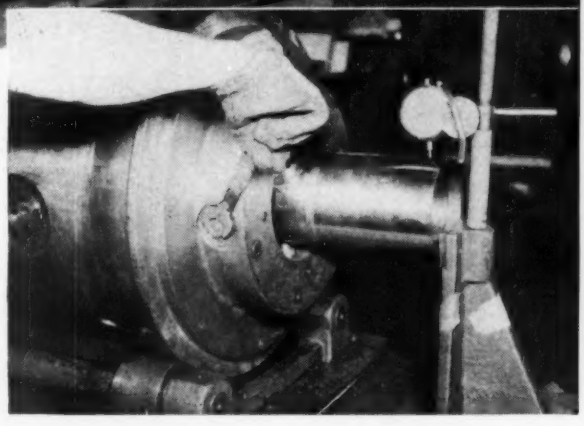
Shuttles Cut Prop-Grinding Time



A special set-up fixture and surface plate are employed to locate the propeller blade in the shuttle

For grinding the hub end of one-piece steel propeller blades, American Propeller mounts the work in a shuttle, which serves as the locator throughout a battery of machines specially equipped to receive it



Four positioning pins grip the shank end

BY THE USE of specially designed shuttles, the location of propeller blades for grinding of their shanks in a series of seven separate operations has been reduced to a single set-up at the American Propeller Corporation plant, Toledo. The shuttles save close to an hour and a half of machine time per blade in this step of manufacture, as compared with conventional methods.

A special locating fixture is provided for the set-up operation. The shuttle, consisting of a steel cylinder with two precision-ground bearing collars at each end, receives the blade.

The blade is clamped in proper axial position by four centering pins at the shank and a two-jawed floating chuck which grips the leading and trailing edges.

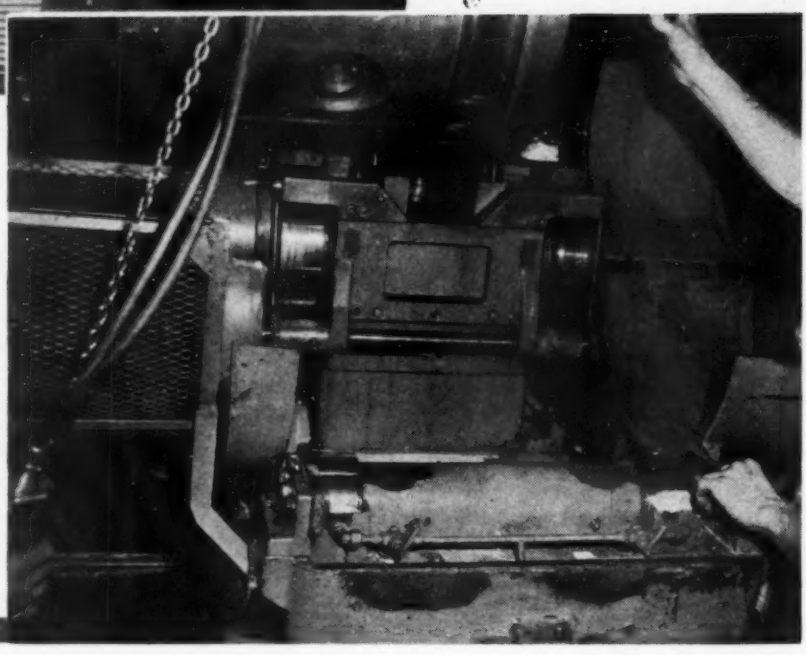
To true the centerline in relation to the shuttle axis, adjustment of the floating chuck is guided by a "wiggler," which bears on the propeller blade tip to provide visual indication of alignment in relation to a fixed point. The shank is brought into concentricity with the ground surfaces of the shuttle bearing collars by use of the centering pins and a dial indicator.

Longitudinal positioning of the blade in the shuttle is achieved by a counterbore at the shank end seating on an inside shoulder of the forward locating collar.

An overhead electric crane, equipped with tongs that enter the lifting holes in the shuttle drum, conveys the assembly to the first centerless grinder.

Each grinder in the line is standard, with the ex-

An electric hoist equipped with tong pickups makes transfer of loaded shuttles from machine to machine a safe, simple operation



Precision-ground bearing surfaces of the loaded shuttle, at top, rest on the two rollers in lower foreground and are driven by the two rollers at the center during grinding operations on the blade

ception of bearing rollers on which the shuttle collars rest, and two driving rollers which rotate the shuttle by direct contact with the locating surfaces. A positive stop, acting against the inside shoulder of the forward bearing collar, holds the shuttle and its blade in exact longitudinal position.

Positive Location at Each Machine

A traversing-head grinder in the first and second operations finish grinds the outside diameter, the de-icing collar and relief of the propeller blade shank. Thereafter, the chamfer, counterbore, balance-weight seat and thread relief of the inside diameter are ground and the outside diameter of the shank above the de-icer collar is finished. Through each of these seven operations the blade and shuttle are positively located in each of several grinders with efficiency approximating a single set-up.

An average of 13 min. is required to locate the blade in the shuttle—less time than would be needed to locate the blade by usual methods directly in a centerless grinder. It is evident, therefore, that the time saving effected by this method actually is in excess of six times the locating period, since it suffices for a series of seven separate grinding operations. Loss from mishandling of the polished blades is practically eliminated and the attendant accuracy holds rejection of the finished shanks to a negligible percentage. Use of the shuttles also reduces training time for new machine operators.

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The Working of PLASTICS

PLASTICS have literally come of age in the last few years. Industry has found these synthetic materials valuable for replacing hard-to-get metals and particularly useful in applications where lightness in weight, dielectric strength, corrosion resistance and ease of production are important selection factors. In addition, manufacturers' research has been tremendously accelerated. As a result many new compounds, and improvements in older compounds, have appeared during the war years.

Although plastics are outstanding because they can be molded or formed to finished shape, there are often many machining operations to be performed on them. Then, too, plastics can be stretch-formed to complex curvatures. This poses production problems. And recently plastics have filled a new role: in cast form they are used as jigs helping to speed machining and press work on metal components.

BASIC TYPES: FORMS AVAILABLE

Plastic materials may be separated into two main groups: thermosetting and thermoplastic. In the former are found those plastics that polymerize under heat and pressure into hard infusible products which will not soften to any appreciable extent on reheating. They cannot be remelted and remolded. Thermoplastic materials soften under heat and harden on cooling. In contrast to the thermosetting types, they may be remelted and remolded any number of times.

Thermosetting Plastics

Phenol-formaldehyde
Phenol-furfural
Urea-formaldehyde
Melamine-formaldehyde

Thermoplastics

Cellulose-acetate
Cellulose-acetate-butyrate
Methyl-methacrylate
Ethyl Cellulose
Polystyrene
Saran
Vinyl compounds

Plastics are available as molding powders. In addition to this, many may be had in cast form, in sheets of thicknesses ranging from a few thousands to more than ½ in. Rods are available in sizes from ⅛ in. to 3 in.; tubes come in a variety of sizes up to 22 in. in diameter. Extrusions of thermoplastic materials are available in widths up to 4 in., in a variety of cross sections.

Due credit is given the following organizations for furnishing data on which the material in this section is based:

American Cyanamid Company
Bakelite Corporation
Carbide & Carbon Chemicals Corporation
Carboloy Company
Catalin Corporation
Cleveland Twist Drill Company
Continental Diamond Fibre Company
Dow Chemical Company
Durez Plastics & Chemicals
E. I. du Pont de Nemours & Company
Greenfield Tap & Die Corporation
Haynes Stellite Company
Monsanto Chemical Company
Morse Twist Drill & Machine Company
National Twist Drill & Tool Company
Plaskon Company
Synthane Corporation
Tennessee Eastman Corporation
Westinghouse Electric & Mfg. Company

PRINCIPLES OF MOLDING AND MOLD CONSTRUCTION

Molding processes can be placed into two distinct classifications: compression and injection. Extrusion is a form of injection molding. In compression molding, a charge either in granule or tablet form is placed in the mold, the mold is closed, and heat and pressure are applied for a certain time interval. In injection molding (primarily used for thermoplastic materials) the granular material is placed in a hopper, fed to a heating cylinder and forced by pressure through a nozzle into the closed die, after it is cooled, the mold opens and the piece is ejected. Injection molding is well suited to automatic cycles, but is limited by available equipment to parts with surface area of 200 sq. in. or less. Extrusion of thermoplastics employs a heating cylinder and an extrusion die shaped to the desired section. The material is forced out and coiled up as it cools.

THERMOSETTING MATERIALS

Compression Molding: Thermosetting materials, such as the phenolics and ureas, require heat for plasticization, and also the application of proper heat for a period of time to polymerize or set them. These materials are usually molded by the compression process. The material is loaded directly into the mold cavity.

Economical commercial molding of such plastic depends upon the following: First, ease of loading. The more conveniently a mold can be loaded, the more efficient the molding operation will be. Second, proper heat properly applied. The heat must be applied simultaneously to the molding material charge while undergoing hardening. Proper pressure is also important. Greater pressure is required for molding large flat shapes, such as trays, where there is a compressive rather than flowing action. Long flow requires greater pressure. Minimum pressure is required for flash type molds, especially in fabricating simple shapes. Care should be taken so that the pressure is not ineffectively dissipated because of too great land areas or uneven or short loading of cavities. Third, it must be possible to remove the piece without damaging or distorting it.

Transfer Molding: In this method, the material is plasticized by outside heating in a cylinder separate from the mold proper and then, as a hot plastic, it is transferred through an orifice into the hot mold where it is to be set or hardened. This method is advantageous when the part design requires delicate insets, when it has an intricate shape, or when large variations in wall thicknesses are necessary.

Jet Molding: A very recent development, basically the injection molding of thermosetting materials. A special heating cylinder and jet are used.

THERMOPLASTIC MATERIALS

Injection Molding: In injection molding, the material is heated to a sufficiently plastic state in a heating chamber and then forced by pressure plunger through an orifice into a relatively cold mold where the molding is formed. The material takes shape and hardens on cooling.

The principles for economical injection molding differ from those for compression molding. First, the feed of the thermoplastic material must be uniform and of proper quantity. Too small a feed will cause short casting due to insufficient material. Too great a feed will cause flashing of the mold or choking of the machine with resultant short molding. Second, optimum temperature of the material in the heating cylinder must be constantly maintained. To maintain consistently good production, variations in time cycle and temperature should be minimized. The lower the heating cylinder temperature the smaller the chances of burning and leakage of the plastic from the nozzle of the heating cylinder. Third, proper pressure on the plastic material in the mold must be maintained. Since the viscosity of the material varies inversely with the temperature, the temperature and the effective pressure must be kept constant. Fourth, so that the molding can be ejected without distortion or damage, it must be cooled until it is sufficiently rigid to withstand slight deformation. The temperature of the mold, the temperature of the injected molding material, the length of time the material is chilled in the die, and the rate and means of ejection are factors which must be carefully regulated and controlled by the molder.

Compression Molding: This is performed on the type of equipment used in compression molding thermosetting materials, except that allowance is made for faster and more uniform heating and cooling of the molds. The mold must be heated to plasticize the material and must also be cooled sufficiently to harden the molding for ejection. As this requires the alternate heating and cooling of great masses of metal in the molding press, as well as the material itself, the process requires a considerably longer cycle than the injection process.

TYPES OF MOLD CONSTRUCTION

There are seven principal types of molds: (1) the flash mold; (2) the landed plunger mold; (3) the loading plate mold; (4) the straight plunger mold; (5) the injection mold; (6) the transfer mold; and (7) the subcavity mold. Because it is wasteful in the use of molding material, the subcavity mold is not in common use.

Fig. 1—The flash mold, the simplest to build and operate, is characterized by a mold cavity the sides of which terminate sharply on a level with the top surface of the lower mold member. The plunger completely enters the mold cavity, forcing the molding compound up the sides until the excess material is pinched off to a thin fin, or flash, between the cut-off surfaces of plunger and cavity. The entire pressing force is supported by the horizontal meeting surfaces. It is wise to distribute this pressure over a larger area by leaving raised pads of approximately the same height as the cut-off surface.

Since the cured compound exerts relatively high frictional resistance to the opening of a mold, the top and bottom plates must be heavy enough and fastened securely enough to the mold parts to withstand the forces exerted by the pull-back cylinders. Also, guide pins and guide-pin bushings should be fastened securely. They must be so ground that they will posi-

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tion the two halves of the mold while allowing them to slip freely together.

The bottom steam retainer shoe should be provided with raised pads at the same height as the top of the cavity so as to distribute the pressure that otherwise would be concentrated on the cut-off surfaces of the mold cavity. Steam retainer shoes that frame the plunger and cavity should have the recesses that contain these members machined the same size so that the plunger and cavity may be ground at the same time.

The designer should check the mechanical stresses in all parts of the mold, paying especial attention to the distance between parallels and adding extra supports in case they are found necessary. Knockout bars should be checked to be certain that they will not bend under the stress of removing the molder part. Knockout pins with well riveted heads should be fastened to this plate by the pin retainer plate. The holes in the plate should be enough larger than the pins that there will be an expansion allowance for the mold when heated. Steam lines should be placed beneath the cavity wherever possible but always around the cavity and plunger.

Clean-out slots should be provided between the top plate and the plunger retainer shoe, if mold pins must enter the plunger for proper line-up or for any other reason. Safety pins, used to prevent damage to knock-out pins and mold cavities, push the knockout bar back into the molding position as the press closes. They should be large enough to withstand the mold-closing pressure. Finally, all assembly screws should be of such size that they will withstand the stresses set up in opening or closing the mold.

Fig. 2—Loading plate mold. Where the design of a mold cavity is such that an unusually large space is required for the molding compound, it is more economical to use a loading plate mold than to machine this space in the cavity. The loading plate rests on top of the bottom steam retainer shoe and the cavity, but is carried with the top mold member when the press opens, thus permitting the use of shorter knockout pins. Push rods are used to reset the knockout bar.

Guide pins should be long enough so that in closing they will pass through the loading plate and into the lower mold member before the plate comes in contact with the cavity. Loading plate molds must be so designed that when the mold is open, there is room for the press operator to work both between the plate and the bottom of the plunger and between the plate and the top of the cavity. The plate itself should be long enough to fit pushdown rods on each end.

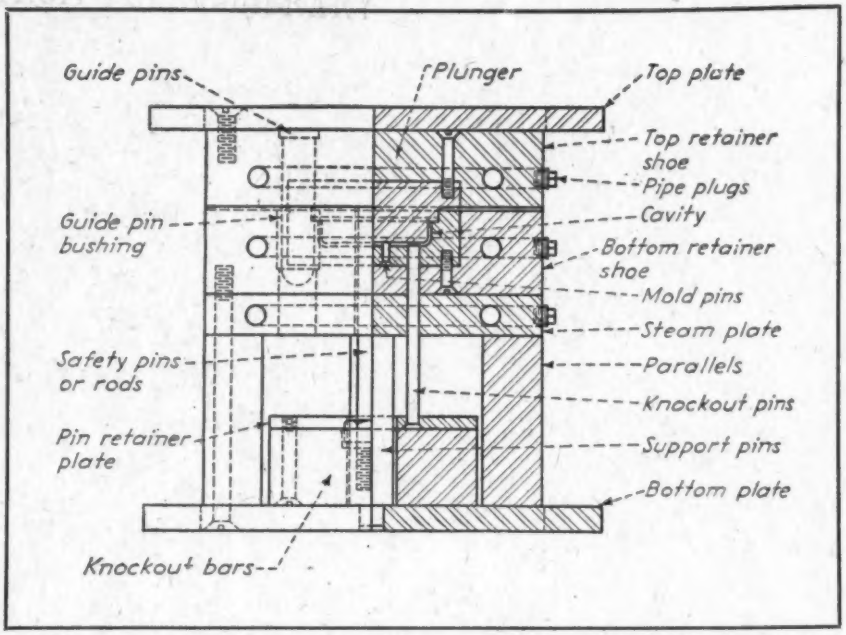

Fig. 1—Cavity in a flash-type mold has sides which terminate sharply with top surface of lower mold member

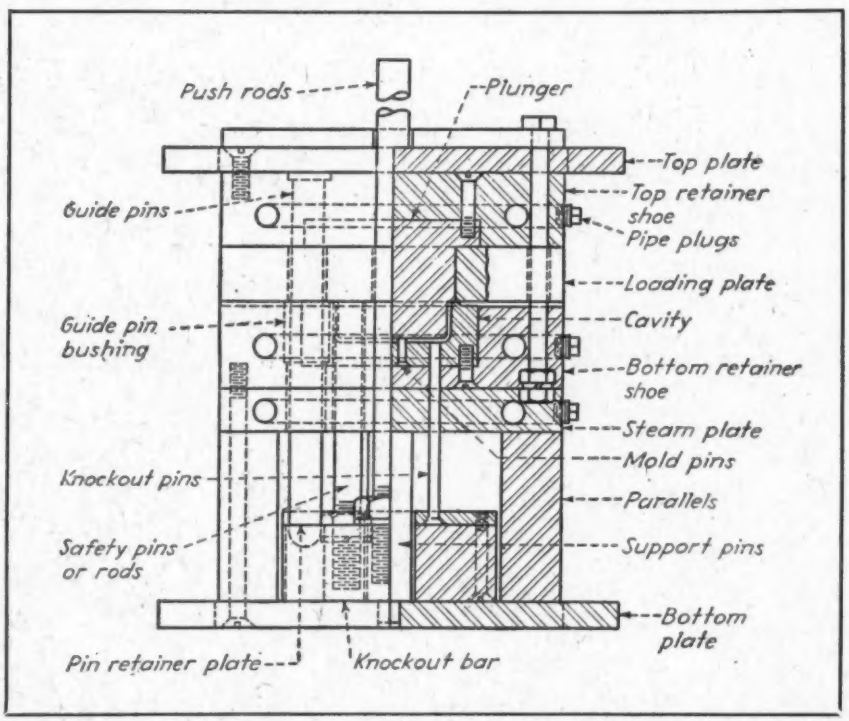

Fig. 2—Loading shoe-type mold. Loading plate rests on top of the bottom steam retainer shoe and cavity

Fig. 3—Landed plunger molds are little different from flash molds. Whereas, in a flash mold the cut-off occurs at the upper level of the bottom mold member, in a landed plunger mold this cut-off occurs at a predetermined distance below the top of the cavity. Although some complications arise from excess molding material being trapped in the cavity, a passage can be provided to allow the excess to escape. It is sometimes best, however, to design the mold without these passages and later provide the size found necessary by actual trial in sampling. The landed plunger mold is especially adapted to molding parts with thin sections since the line-up of mold members is very accurate.

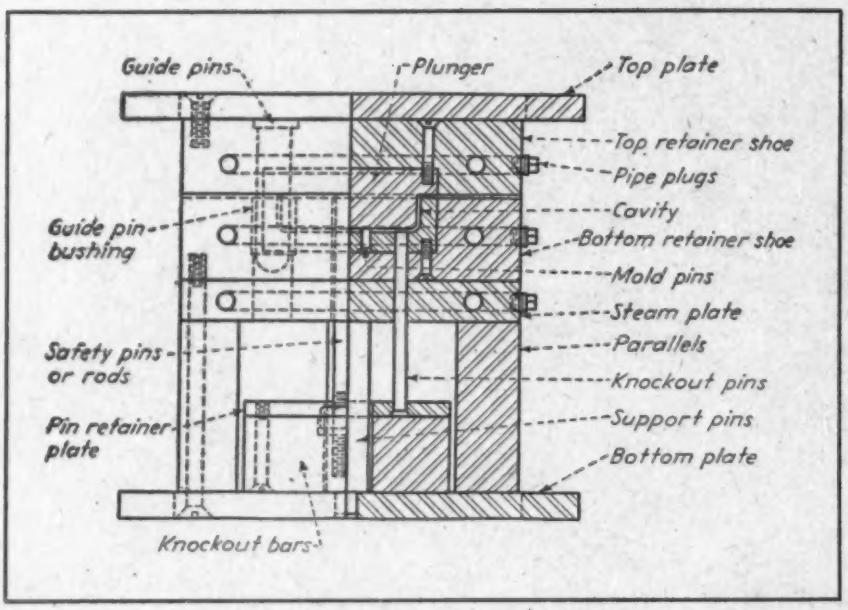

Fig. 3—Landed plunger—mold provides accuracy of alignment of mold members

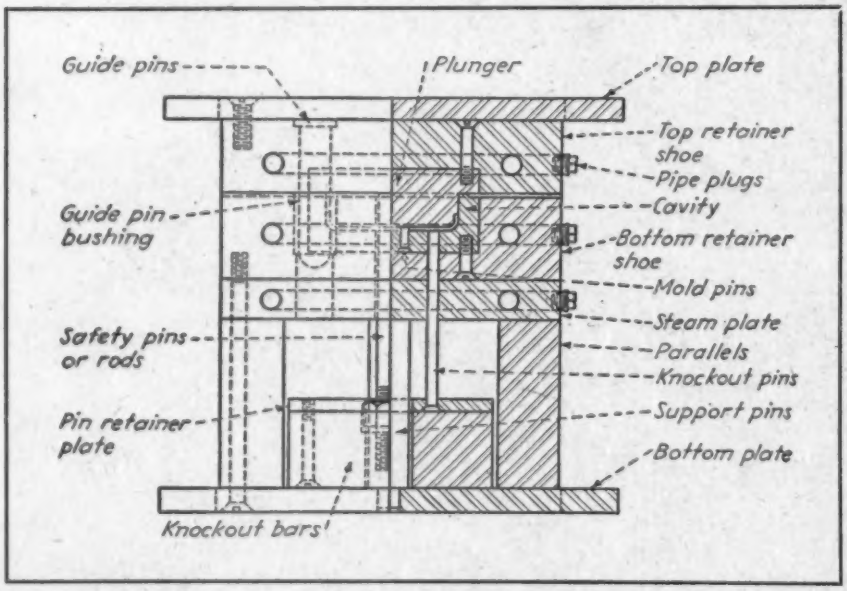

Fig. 4—Straight plunger mold. Constructed so that ram exerts full pressure on the molding compound

Fig. 4—Straight plunger mold. The considerations affecting flash-type molds and landed plunger molds apply to straight plunger molds, with the exception that in a straight plunger mold the plunger enters the cavity without resting on a land or horizontal cut-off. This construction causes full pressure to be exerted on the molding compound and results in greater densification of molded parts. It also results in varying wall thicknesses, which may be objectionable.

Fig. 5—Injection mold. Thermoplastic compounds are most economically molded in injection molds. Such materials generally require much higher pressures than do standard compression-molding materials. Presses available for injection molding have such restricted spaces between strain rods that an entirely different technique must be employed in design of the molds. Among the many items to be considered are proper support to withstand the higher pressures, correct design and placement of sprues and gates, interlocks where line-up is important, and sufficient anchorage of movable mold members. In view of the exteremely high pressures involved, mold members should be properly lined up and the butting surfaces of the meeting members should be carefully finished. Because of this close fit, it is necessary to provide means for venting the air that would otherwise be trapped in the mold when it is closed in the press.

Fig. 6—Transfer mold with a transfer plunger entering the transfer well and with a limit stud. Transfer molding, similar in many respects to injection molding, is used for the injection of a heat-softened thermosetting material into a heated mold, whereas injection molding is applied to the injection of a heat-softened thermoplastic material into a (normally) cold or chilled mold. The advantages of transfer molding are that cleaning costs on the molded parts are greatly reduced, more delicate inserts and pins may be used than would otherwise be possible, and closer tolerances on dimensions of the finished part can be met.

MOLD PLATING

Compounds used in compression molding plastic products have an abrasive action on the surface of the mold members. After a few hundred thousand parts have been molded in even the best hardened steel molds, a perceptible amount of wear takes place. To reduce such wear, a fairly heavy chromium plate (0.001 to 0.002 in.) is sometimes applied to all parts of the mold that come in contact with the compound.

An exception to this rule occurs when it is desired that the molded parts either remain in the cavity or be extracted on the plunger when the mold is opened. In such cases, the molded part will remain on the mold member that is not plated. The advantages of chromium plating are longer mold life because of greater hardness, greater abrasive resistance, greater corrosion or staining resistance and decreased manufacturing cost because the lower coefficient of friction allows easier extraction. The length of time required to "break in" a mold is cut down by chromium plating. Worn mold members can be built up to proper dimensions by chromium plating and will then usually outlast the original unplated mold.

DESIGN CONSIDERATIONS

The molding material must be known, since different materials require different molding pressures and temperatures, different shrinkage allowances to compensate for the decrease in size of the molded part when it is extracted from the mold.

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Plastic molding materials vary in shrinkage from 0.01 to 0.009 in. per in., depending upon the nature of the material (see Table I). For example, plastic molding materials with mineral fillers will shrink less than the standard wood-flour filled materials. If the pieces are to be cooled in the mold under pressure, the allowance for shrinkage should be less than when they are removed hot. A standard wood-flour filled material will shrink 0.0035 to 0.004 in. per in. when cooled in the mold, against 0.006 to 0.008 in. per in. when pulled hot.

Heavy sections tend to shrink more than thin sections. A combination of thick and thin sections should be avoided because unbalanced stresses will be set up by the variation in shrinkage. This will cause the molded piece to warp or distort. For the same reason, a hole or depression in a piece should not approach too closely to the opposite face. A mark is likely to show because of uneven shrinkage.

Form of the molding material—bulk or preform—determines the loading space required. Location and size of guide pins are based on mold size and construction. Heating channels should be formed around the cavity and plunger and beneath the cavity. In all cases where the cavity is machined out of the same block as the steam retainer shoe, ample distance (at least 5/8 in) should be allowed between the cavity walls and the heating channels. The design should be studied to determine the proper location for knockout pins, which should be large enough in size and in number, to assure proper ejection of the molded part with little or no pin maintenance.

Mold pins, or projections in the mold that form holes in the molded part, should be checked for proper proportions. Lengths of slender pins should not exceed twice their diameter. Draft or tapered sides should be used where allowed by the design and in the largest amounts possible in order to facilitate extraction of the molded part. The necessity for and the location of pull pins and wedges should be determined. The desirability of making a mold member in sections or in one piece should be decided.

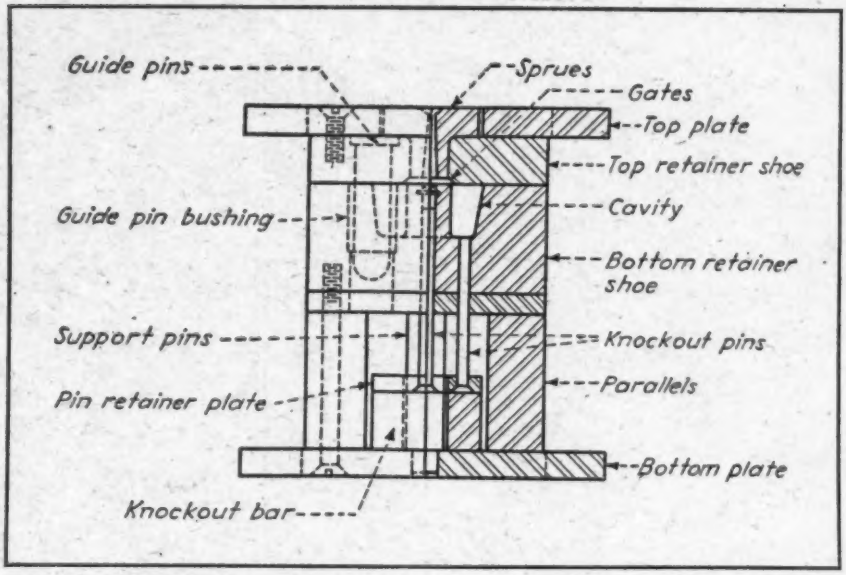

Fig. 5—Injection molds must be accurately finished and aligned, because of the high molding pressures

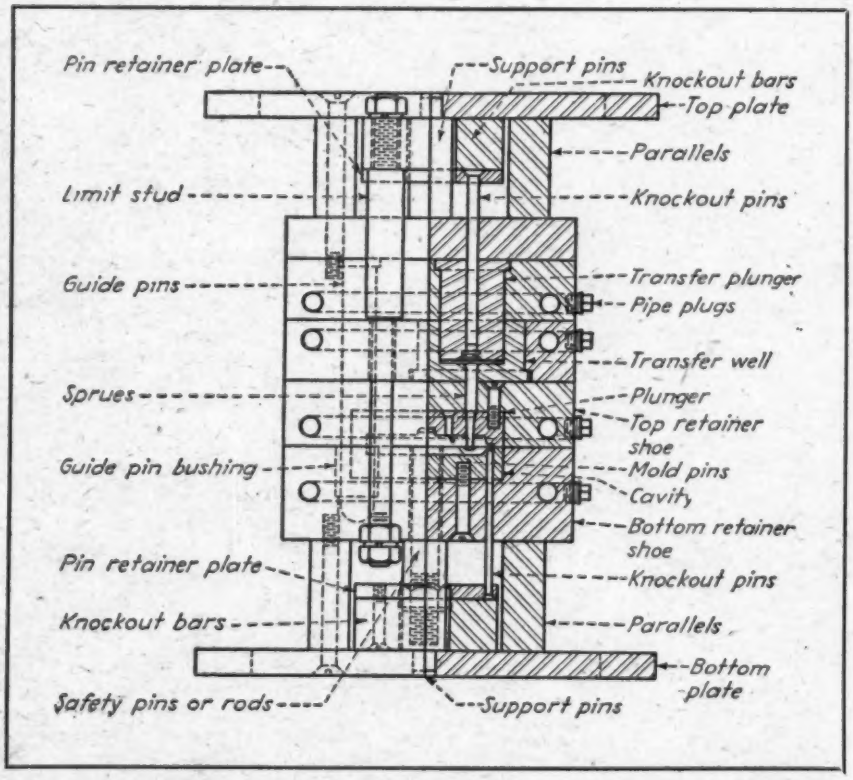

Fig. 6—Transfer mold for injection of heat-softened thermosetting materials

Special steels are generally used for molded parts. For hobbed mold cavities, a special grade of carbon-chrome-silicon steel is required for the hard, tough master or hob that is pushed into the equally special SAE 3110 hobbing steel.

SAE 3312 steel is used for machined parts of molds, both compression and injection. This steel, as well as the SAE 3110 hobbing steel, must be case-hardened after the parts have been finished to their final form to provide surface hardness. A case of 0.040 to 0.050 in. is applied to the molded parts and to test pieces that will subsequently be broken to check depth. Small mold pins are made of music wire, larger ones of drill rod.

The foregoing S.A.E. numbers are merely indications of typical formulations used for molds. Steel manufacturers have done considerable work on improving the processing of special steels for plastic molds. These new steels emphasize machinability, strength, better hardening properties and freedom from inclusions. War developments promise still further progress in the development of mold steels.

TABLE I — MOLDING DATA ON PLASTIC MATERIALS

MATERIAL	COMPRESSION MOLDING Temperature Deg. F	COMPRESSION MOLDING Pressure Lb. per Sq. In.	INJECTION MOLDING Temperature Deg. F	INJECTION MOLDING Pressure Lb. per Sq. In.	Bulk Factor Loose Powder Solid	Mold Shrinkage
Phenolic						
Wood flour	280-360	2,000-4,500	.....	.....	2.2-2.8	0.006-0.01
Mineral	270-350	2,000-4,000	.....	.....	2.0-6.0	0.002-0.006
Fabric	270-360	3,000-8,000	.....	.....	3.0-11.0	0.003-0.007
Laminated						
Paper	250-350	1,000-3,000	.....	.....	1.5-3.0	.....
Fabric	250-360	1,000-3,000	.....	.....	1.5-3.0	.....
Glass	275-350	1,000-3,000	.....	.....	.....	.....
Urea	275-340	2,000-8,000	.....	.....	2.5-3.0	0.006-0.011
Melamine	280-340	1,000-6,000	.....	.....	2.0-2.5	0.004-0.011
Cellulose Acetate	275-310	2,000-5,000	335-390	10,000-20,000	2.0-2.8	0.0025-0.0045
Cellulose Acetate-butyrate	250-350	1,500-5,000	300-440	8,000-30,000	2.0-2.4	0.002-0.009
Ethyl Cellulose	320-360	1,000-5,000	380-425	3,000-30,000	2.2-2.5	0.004-0.007
Methyl Methacrylate	280-360	1,000-4,000	325-450	5,000-30,000	1.6-2.4	0.001-0.006
Polystyrene	275-350	300-5,000	300-500	3,000-30,000	2.0-2.5	0.002-0.008
Vinyl	270-290	1,500-2,000	280-300	3,000-30,000	2.0	0.001
Saran	220-350	500-5,000	300-400	10,000-30,000	2.0	0.004-0.008

MACHINING AND FINISHING PLASTICS

After molding plastics are first rough finished to remove flash. Drilling and tapping operations and other machining follow, after which a final buffing or polishing is done. Sprue marks on injection molded parts are often removed by hand filing. The finishing operation is done by buffing with abrasive belts.

One of the recommended cloths for finishing has a silicon carbide abrasive grain bonded by synthetic resin. These abrasive belts are available with grits of No. 24 to 600 mesh size. Grades ranging from 220 to 230 mesh have been found most useful for rough finishing plastics and for the removal of sprue projections and heavy flash lines. Belts may be operated dry. Belt speeds should range from 2,000 to 3,000 ft. per min. For irregular surfaces, thin and narrow belts give best results.

All plastics are poor conductors of heat. Heat caused by friction of cutting tools has to be carried away either by the tool, by air or by coolant. Most machining is done dry. Since some thermosetting plastics, such as the phenolics and ureas, frequently contain abrasive fillers, tools may be dulled easily. With improper speeds and feeds, tools may even burn. In machining plastics that are subject to softening, the frictional heat will cause the plastic surface to become gummy and build up a film of burned resin on the tool. In the case of high-speed drills this may cause sticking, possible cracking and consequent inaccurate work. Stellite and carbide metal-cutting tools are excellent for machining all types of plastics and will be found economical to use when long production runs are required. Lapping or honing the cutting edge is helpful in prolonging tool life.

DRILLING

For maximum efficiency on holes to ¼ in. in diameter, drills especially designed for plastics are used. They are available in 60 to 90-deg. included-angle points with polished flutes, wider than on the standard machine drill and have a slow helix. Tests indicate that 260 deg. included-angle is desirable for sections up to 3/16 in. thick, and a 90 deg. point for thicker sections. A slow helix works best for through holes and a fast helix is best on blind holes. A 15-deg. lip clearance is provided by the tool.

Phenolics. Drills must be backed out and cleared frequently. This will free chips, especially in drilling deep blind holes. An air jet, directed into the hole and on the drill point, will increase the production of the standard drill twenty to thirty times before resharpening is required. Speeds of 100 to 300 ft. per min. are ordinarily used for drilling, but for materials containing inert or abrasive fillers, a slow speed of approximately 75 ft. per min. should be used.

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Urea. Drilling recommendations follow those for phenolic wood-flour filled. Speeds vary between 100-300 ft. per min. An air jet aids cooling.

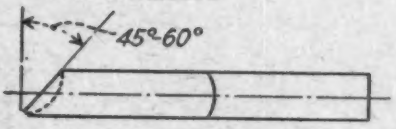
Cast Phenolics. Drills sometimes cut about 0.003 in. undersize. Speed should be as high as possible without burning and the tools should be backed out often. Negative rake helps to clear the drill. A half-round drill or boring tool is useful in drilling deep holes.

Laminated Plastics. Ease of machining varies directly with type of laminate. Paper and fabric will tend to dull the tools. Grind the lip thin with little rake. Plenty of clearance will prevent splitting and grabbing. The drill should not be forced. It should be kept sharp and light pressures used. Since the material shrinks, a slightly oversize drill is usually specified. For through holes, it is good practice to back the plastic with solid material or to use jig plates above and below. When drilling parallel to the laminations a flat or "bottom" drill will usually avoid splitting.

Thermoplastics. Heavy feeds may strain or chip piece. Highly polished or chromium plated drills help prevent cracking and crazing. Slow drill speeds minimize the tendency to heat up. Water coolant will prevent the material from softening. Soap can be used as a lubricant for holes over 1/8 in. in diameter. Drills should be backed out frequently to clear chips. Light feeds reduce strain and reduce tendency to chip or develop strain cracks. Parts molded from vinyl plastics can be drilled in much the same manner as other synthetic materials. Standard drills and the usual feeds are used. For deep holes, those whose depths exceed twice the drill diameter, drills with extra large flutes should be used.

For drilling small holes in styrene or vinyl plastics, speeds of 4,000 to 6,000 r.p.m. are recommended. When the feed is kept as high as practical, the drilling time will be minimized. The reason for this is that the shorter the drilling time, the less is the tendency for the bit to raise burrs around the edge of the hole. When the hole is being drilled properly and the operation is most efficient, the chip will usually emerge in a tight spiral similar to that produced while drilling mild steel.

Design of Jigs for Drilling. Close-fitting drill bushings should be avoided. Close-fitting bushings may increase the friction on the drill and may also increase the tendency of the chips to plug up the drill flutes. If the operation is such that a drill bushing is absolutely essential, a floating



Boring tool for plastics

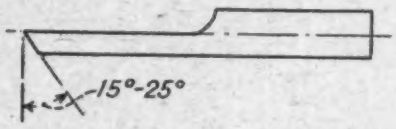


Fig. 7—Recommend profile for boring plastics. Clearances are larger than for metal-working tools

leaf or templet should be employed. When using a templet, the hole should be spotted with the templet in place, using the drill size corresponding to the final hole size, then the templet should be removed and the hole completed. Pilot holes should be avoided, except in special instances when the hole is to be reamed or counterbored.

REAMING

It is not common practice to ream molded plastics. Reaming is used primarily to remove light fins or flash in holes. Where it is necessary to offset tapered holes, good results can be obtained if an expansion reamer is used. In conjunction with a self-centering floating holder, a fast feed and slow speed—one not over 50 to 100 r.p.m.—should be used. On thin sections, not over 1/8 in. thick, holes should be drilled within 0.001 in. size and a hardened and polished rod used to burnish them to the desired dimensions.

THREADING AND TAPPING

High-speed nitrided and chromium plated taps are best for the threading of small tap sizes. Speeds used range from 40 ft. per min. to 54 ft. per min. Tools have three flutes rather than the four commonly used in machine work. A negative rake of about 5 deg. on the front face of land will in some measure help avoid binding a tap in the holes when backing out. Small holes can be tapped dry. Water is a better tapping medium than lard, oil or kerosene. Machine taps 0.002 in. to 0.005 in. oversize are recommended as these give 75 percent of full thread to prevent the tap from breaking. A slight chamfer or countersink will minimize rolling up material around the edge of the hole. Holes larger than 1/4 in. should be molded-in rather than threaded or tapped later, except in thin sections.

Standard machine, pipe tapping and threading dies can be used satisfactorily on parts molded of vinyl plastics. The feed should be uniform and continuous. Speed, which should be moderate to slow, is limited only by the rate of heat development. On lathe operations, the threading or chasing tool should be relieved con-

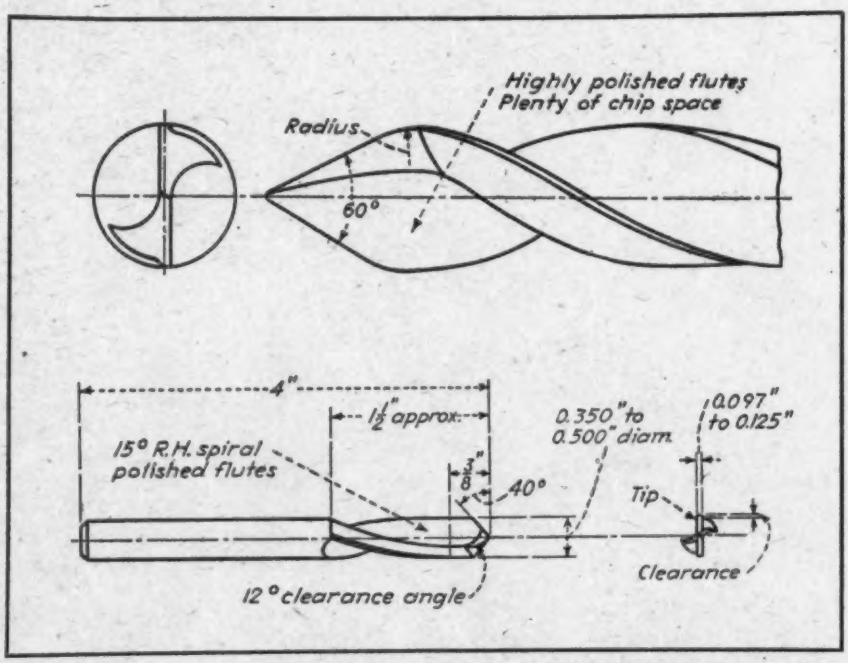


Fig. 8—Drills for plastics usually have 60-90 deg. included angle points and highly polished flutes. The design shown in the lower half of drawing is one especially developed for laminated plastics

TABLE II—MECHANICAL AND ELECTRICAL

PROPERTIES	THERMOPLASTICS						
	Cellulose Acetate	Cellulose Acetate Butyrate	Ethyl Cellulose	Acrylic	Polystyrene	Vinyl	Saran
Specific Gravity	1.27-1.37	1.14-1.37	1.08-1.18	1.18-1.20	1.050-1.185	1.18-1.60	1.68-1.75
Tensile Strength, lb. per sq. in.	2,000-11,200	2,500- 9,900	2,500-14,000	5,800- 8,800	5,000-10,000	1,000-10,000	4,000-40,000
Compressive Strength, lb. per sq. in.	7,000-30,400	7,500-23,100	10,000-12,000	13,000	11,500-18,000	10,000-12,000	7,500- 8,500
Flexural Strength, lb. per sq. in.	3,700-18,000	3,000-13,100	4,000-12,000	9,000-15,000	8,000-19,000	10,000-14,000	15,000-17,000
Impact Strength, ft. lb. per in. of notch Izod	0.7-4.2	0.7-5.5	3.6-8.0	0.2-0.4	0.35-1.2	0.2-0.6	2-8
Modulus of Elasticity, lb. per sq. in. x 10^5	1-4	2.0-3.5	1-5	2.3-5.0	1.7-6.0	3.5-4.1	0.7-2.0
Hardness, Rockwell M scale	25-107	18-99	25-86	18-25 Brinell	55-115	12-15 Brinell	38-65
Thermal Expansion, 10^{-5} per deg. C.	8-16	11-16	10-14	7-9	6-8	7	15.8
Operating Temperature, deg. C., continuous	140-180	100-160	120-200	circa 160	150-185	130-150	175
Softening Point, deg. F.	140-260	140-250	125-203	150-203	[190-275]	140-175	240-280
Distortion Under Heat, deg. F., dry	103-214	117-215	120-200	140-180	169-194	140-160	150-180
Thermal Conductivity, cal. per sec. per $cm.^2$ per deg. C. per cm. x 10^{-4}	45-78	45-78	56	43	19	39.5	2.2
Cold Flow	Slight	Slight	Slight	Slight	Very slight	Slight	Slight
Dielectric Strength, volts per mil.	275-900	275-900	400- 2,000	500	500-700	400- 2,000	500- 2,500
Dielectric Constant, 60 cycles	3.5-6.4	3.5-6.4	2.6-4.4	3.5-4.0	2.5-3.2	4.0	0.03-5.00
10^3 cycles	3.5-6.4	3.2-6.4	2.5-4.0	3.0	2.5-3.0	4.7	.003-5.00
10^6 cycles	3.2-6.2	3.2-6.2	2.0-3.5	2.8	2.5-3.0	4.0	0.03-5.00
Power Factor, 60 cycles, percent	1.0-6.1	1.0-6.1	0.7-1.0	7.0	0.01-0.03	1.43	0.03-0.15
10^3 cycles, percent	1.0-6.1	1.0-6.1	0.5-5.0	7.0	0.01-0.03	1.3-1.43	0.03-0.15
10^6 cycles, percent	0.8-6.0	0.8-6.0	0.7-3.0	1.5	0.01-0.04	2.0-6.5	0.03-0.15
Water Absorption, percent by wt., 24 hr.	1.2-6.9	1.0-2.0	0.5-2.0	0.3-0.5	0.0-0.3	0.000-0.415	0.1
Trade Names	Tenite I Lumarith Bakelite Fibestos Nixonite Plastacele	Tenite II	Hercules Ethocel Lumarith E. C.	Lucite Plexiglas	Styron Loalin Bakelite Lustron	Vinylite Butacite Koroseal Monsanto	Saran

siderably in order to reduce side friction. Any form of thread can be used, but the American National Standard for machine screws is most satisfactory.

LATHE OPERATIONS

Phenolics, Ureas. In turning, facing and boring operations, tools having less relief and more rake than those used for steel or other metals are recommended. Cutting speeds are 200 to 600 ft. per min. for high-speed steel tools and 500 to 1,500 ft. per min. for Stellite metal-cutting tools.

Cast Phenolics. Tools commonly are given zero or slightly negative back rake and 15 to 18 deg. relief. Tools must be sharp and best results are secured when the chips are ribbon-like. For facing cast phenolics, tool speeds range from 450-6,000 r.p.m. Facing tools sometimes are set slightly above center. Too pointed an edge on facing tools tends to create chatter. On rod machines, formed circular cutters and cut-off tools can be used to advantage, or cut-off can be done with a saw.

Laminated Plastics. For screw machine operations on laminated tubes it is better to specify a smaller inside diameter than required for finished size, or to use laminated rod and drill it to size. Cutting feeds recommended are: 0.007-0.015 in. per revolution for drilling; 0.010-0.015 in. per revolution for turning; 0.002-0.005 in. per revolution for cut-off; and 0.002-0.003 in. per revolution for forming.

The following spindle speeds are recommended for hand screw machines: 1-in. diameter and over, 800-1,000 r.p.m. under 1-in. diameter, 1,500-2,000 r.p.m.; 7/16-5/8 in. diameter, 3,600 r.p.m.; 1/8 in. diameter and under, 5,000 r.p.m. Flooding with lard oil and kerosene tends to increase production and to prolong tool life.

Acetates, Styrenes. Tools should have zero rake and plenty of relief set at an angle of 60 deg. to the spindle. Cuts should be made at a surface of about 65 deg. per min. and a feed of 0.010 in. per revolution. A smooth surface is obtained with a 0.020 in. depth of cut.

Acrylics. Turning is done with tools having zero rake and plenty of relief, set at an angle of 60 deg. to the spindle. Cuts should be made at a surface speed of about 65 ft. per min., and a feed of 0.010 in. per revolution. A smooth surface is obtained with a 0.020-in. depth of cut.

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PROPERTIES OF PLASTIC MATERIALS

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THERMOSETTING PLASTICS				THERMOSETTING PLASTICS				
PHENOLIC				LAMINATED PHENOLIC			Urea	Melamine
Wood Flour Filler	Mineral Filler	Fabric Filler	Cast	Paper Base	Cotton Base	Glass Fabric		
1.25-1.52	1.59-2.09	1.3-1.4	1.27-1.33	1.3-1.4	1.55-1.80	1.4-1.6	1.45-1.52	1.76-1.98
4,000-11,000	4,000-10,000	6,500-12,000	3,000- 8,000	7,000-18,000	8,000-15,000	14,000-20,000	5,000-13,000	5,500-10,000
16,000-36,000	18,000-36,000	20,000-32,000	7,000-15,000	20,000-40,000	30,000-44,000	42,000-47,000	20,000-35,000	30,000
8,000-15,000	8,000-20,000	10,000-13,000	7,000-15,000	13,000-30,000	13,000-30,000	20,000-27,000	10,000-16,000	7,500-16,500
0.20-0.56	0.22-0.72	0.8-4.8	0.1-0.4	0.6-7.6	1.4-15	1.8-11	0.15-0.32	0.27-0.40
10-15	10-45	7-12	3-10	4-20	3.5-15	10-20	12-15	12-16
100-125	85-120	85-110	80-130	70-120	70-120	105-110	110-130	.....
3.7-7.5	2.5-4.0	2.6	2.8	1.7-2.5	1.7-3.0	.....	2.5-3.0	2.0-4.5
250-450	450	230-350	160	212-400	212-350	480	170	210-400
None	None	None	176-212	None	None	None	None	None
240-285	.....	.....	.....	320	320	320	230-280	250-385
4-12	8-20	3-6	3-5	5-8	5-8	5-8	7.1	.....
None	None	None	None	None	None	None	None	Slight
300-500	250-500	150-450	300-450	400-1,000	150-600	450-650	400-550	340-410
5-12	5-20	5-10	5-10	.....	.....	.....	7.0-8.75	6.4-11.5
4-8	4.5-20	4.5-6	4.5-8	.....	.....	.....	6.4-8.75	.....
4.5-8	4.5-20	4.5-6	5-8	3.6-5.5	4.5-7	3.7-4.5	6.4-8.75	6.7
0.04-0.30	0.10-0.30	0.08-0.30	0.025-0.20	.....	.....	.....	0.04-0.10	0.07-0.17
0.04-0.15	0.10-0.15	0.08-0.20	0.005-0.08	.....	.....	.....	0.035-0.055	.....
0.035-0.1	0.005-0.10	0.04-0.10	0.01-0.045	0.02-0.08	0.02-0.08	0.01-0.02	0.027-0.039	0.041
0.2-0.9	0.01-0.3	0.6-2.5	0.01-0.5	9.0.3-0	0.3-9.0	0.3-0.5	1.3	0.08-1.7
Bakelite Durez Textolite		Resinox Insurok	Bakelite Catalin Opalon	Celeron Dilecto Formica Micarta	Insurok Phenolite Spauldite Synthane	Textolite	Plaskon Beetle Bakelite	Melmac Monsanto Catalin

Vinyls. Simple turning, facing, boring and chasing operations are performed satisfactorily with most ordinary metal-cutting tools provided that the front and side relief of that tool are increased by about 50 percent over the relief used to machine steel. The added relief reduces the rate of heat formation and produces good surface finishes and free-flowing chips. An increase in rake angle, made by hollow grinding the top cutting face, offers some advantages in directing the chip away from the work. However, the accompanying reduction of cutting angle results in a greater tool wear. With surface speeds between 250 and 300 ft. per min., depths of cut can be as high as ¼ in. and rates of feed up to 12 in. per min. are possible. Higher speeds and feeds can of course be used with lighter cuts.

Cutting-off tools should also be ground with increased front and side relief. In using them, the surface speed should be reduced to approximately half that used while turning. Slower speeds tend to roughen the cut surface, whereas faster speeds may cause overheating of the material.

MILLING

Where milling of molded parts is required, milling speeds and feeds in the range used for brass are recommended. Speeds are 400 ft. per min. with carbon steel cutters and 1,200 to 1,600 ft. per min. with carbide cutters. Single and double-bladed fly cutters are sometimes used at high speed with fine cuts. Where little material has to be removed, a high-speed woodworking shaper with a carbide-tipped tool can be used to advantage.

The general rules that apply to turning, facing and boring operations also hold for milling vinyl plastics. Standard cutters can be used, but higher speeds are feasible if extra relief is ground on the cutter blades. Here again, it may be necessary to use an air blast to assure proper chip removal from the milling cutter. Wherever possible it is recommended that helical milling cutters be used, and that the number of teeth in the cutter head be such that at least two of them are in contact with the work at all times. Plain cutters are to be avoided, because of overheating caused by side friction. Milling cutters and blades should be given the same general care as turning, facing, and boring tools

to assure that a minimum of surface friction is developed during machining.

Milling laminated plastics should never be done in a direction which will tend to separate the laminations. This is especially important in milling slots. In general, it is considered best to remove the full depth of material in a single cut.

In designing fixtures for milling, it is essential that the fixture does not cause distortion of the work. Since parts molded from plastic materials are less rigid than metals and thus more easily distorted, they should be well backed up during the operation and should be so positioned that the pressure of the milling cutter is against the backing. When possible, cutters should be operated so that the chips are discharged from the leading edge of the cutter in contact with the work. To use a cutter in this manner implies that the machine is in good mechanical condition. Considerably less friction is developed if the cutter takes the heavy part of the chip first, as in climb milling.

GEAR CUTTING

In cutting laminated blanks, the feed should be the maximum that is possible without showing marks on the teeth. A coarse feed tends to reduce wear on the cutter edges. In hobbing, it is not usually necessary to make roughing and finishing cuts. Hobs of ¼-in. pitch diameter may be run at 140-210 r.p.m. with feeds of 0.040-0.080 in. On shapers, gears are cut at 100-130 strokes per min. with a fine feed, unless both roughing and finishing cuts are taken. In the latter case, 0.010 in. of stock for finishing may be removed at any desired speed or feed. In all gear cutting, the laminated stock should be backed up with wood or cast iron where the cutter breaks through the surface, to avoid fraying or rough edges.

SAWING

Phenolics, Ureas. Sawing is done chiefly on circular and band saws. Band saws are recommended at times for straight cutting because they run cooler than circular saws. Band saw manufacturers advocate saw teeth set to clear, some advocating half the thickness of the blade on each side so that saws give a width of cut double their thickness. Narrower saws and more set are needed for cutting curves than for straight cuts. Band saws, just soft enough to permit filing are recommended, but saws must be kept sharp. Dull saws cause chipping and may result in breakage. Sawing is usually done dry, but some recommend water for cooling. Saw teeth should have little set and eight to nine teeth per inch—turning to 1,800 to 2,500 ft. per minute.

Laminated Plastics. For laminated stock, circular saws which are hollow ground and have no set generally are recommended where cuts must be smooth. Where rougher edges are permissible, saws with teeth set as for wood are satisfactory, this set making it unnecessary to hollow grind. Decreased set as diameter increases is advocated by some; others recommend radial teeth with zero rake. Table III gives the number of teeth and other specifications for sawing teeth of different thicknesses and tubes of different diameters. Chipping is caused by dull saws or by setting the saw too high or too low in reference to the table. Sawing usually is done dry. Smoother cuts sometimes are obtained by heating the material.

Acetates, Styrenes. Done with circular saws having nine to twelve teeth per min. for thin sheets and six teeth per in. for thicknesses over ¼ in. Saws six to nine in. in diameter are run at speeds of 3,000 to 3,600 r.p.m. They should be hollow ground. They usually are 1/32 to 1/16 in. thick. A water spray gives a cleaner cut. One large saw manufacturer recommends that pieces be cut with a stream of water running in the kerf while the saw is cutting. This applies to both circular and band saws; otherwise, the thermoplastic materials will fuse. The circular saws recommended are 14 in., 12 and 9 gage, 130 teeth, 10 deg. rake to be operated at 3,000 r.p.m. They are made of a special alloy steel stock.

For band sawing, manufacturers suggest a band saw which is 19 to 20 gage, having twenty points to the inch and hardened and tempered. It should be operated at 4,000 to 4,500 ft. per min.

Vinyls. The most satisfactory method of sawing parts molded of vinyl plastics is with an underwater saw. When sawing unfilled resin, equipment should be fitted with hardened steel saws. The surface speed recommended is 3,500 to 4,000 ft. per min. (1,200 r.p.m. for a 12-in. saw) and the saw should carry 10 to 14 teeth per inch. The teeth should have no set. An average speed of travel through the stock is approximately 3 to 4 in. per min. It is possible, in some cases, to use speeds up to 12 in. per min. The finish of the sawed surface and the possibility of the stock chipping at the leaving edge are affected by the rate of travel of the saw through the stock, the sharpness of the saw, and whether the stock being sawed is a solid piece or several smaller ones clamped together. While filled vinyl resin compounds can be satisfactorily sawed with an underwater saw in a manner similar to sawing the unfilled compounds, the effective life of the saw is materially reduced by the filler. Fine-abrasive saws are preferable to metal saws. The abrasive saws will produce an equally good finish on the sawed surface at a considerable increase in saw life. Rubber-bonded cut-off wheels are not usable, but resin-bonded saws are perfectly satisfactory. Notching the saw helps to promote self-cleaning.

TABLE III—SAWING SPEEDS FOR PLASTICS

Material	Speed	Saw Diam.	Thickness	Teeth Per In.
Sheet ⅛ in.	2,500-3,000	10	⅛	6
⅛ in.	2,500-3,000	14	⅛	4
¼ in.	2,500-3,000	14	⅛	4
Tubing Under 1 in.	2,500-3,000	15	⅛	8
Over 1 in.	2,500-3,000	17	⅛	5

PUNCHING

Punching, blanking, shearing and shaving are done extensively on laminated plastics. Thickness of sheet, character of filler used, and temperature of the sheet are factors that determine the operations to be used. Some sheets can be punched cold, up to a certain thickness. Others require heating; usually the thickness which

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can be punched is greater when the sheet is hot. Heating can be done on hot plates or in ovens. The recommendations of the laminated supplier, both as to temperature and length of heating, should be followed. Some laminates can be heated to as much as 280 F. without injury and others only to 250 F. Too high a temperature may affect the finish of the sheet and too long a heating may make it brittle. Punching should be done within 2 min. or less after heating.

Laminated materials yield somewhat when punched, as a result, the hole produced is slightly smaller than the punch. Allowance of about 3 percent of thickness punched must be made for this in punching as well as in blanking. A very close fit between punch and die, approaching a sliding fit for cold work, is required. Stripper plates should fit the punch closely to prevent lifting at the edge of the hole as the punch is withdrawn. Progressive dies are satisfactory but best results are secured with compound dies which place a spring load on the stripper. Blanking punches should be from 0.0001-0.008 in. smaller than the size of blank required. Press speeds are about 150 strokes a minute.

Punched blanks often have rough edges. This can be remedied by shaving in a hollow die, with a 45-deg. cutting edge which must be sharp, using a brass or soft steel plunger. Shaving is done hot as a rule, but can be done cold on some materials up to about ⅛ in. thickness.

Cellulose acetate sheets can be punched and blanked with sharp edge tools. To obtain smooth edges the sheet is warmed to about 125 F., not enough to affect its polish. As the material is compressed by the cutting action one edge is concave and the other convex. This is hardly noticeable on thin sheets. Acrylics are blanked similarly with sharp edge punches, but heating to 180 F. is recommended for this type of material.

EMBOSSING

Embossing, as in stamping or pressing letters, often is done in branding parts of plastic materials. Heated brass dies are used. The stock also is heated in some cases. Letters are often wiped in after embossing, but can be made to stand out readily by covering the area to be marked with metal leaf before embossing, the pressure causing the leaf to cling in the recession where the pressure is applied. Kick presses often are used.

Cast phenolic blanks, previously heated until soft, are often pressed in steel dies to form a design on one surface. This sometimes involves a fairly deep impression requiring considerable flow of material and may include punching of holes, as in buttons.

POLISHING

Ashing, polishing and buffing is done on nearly all types of plastics, either to improve the finish or to remove sanding or tool marks left by preceding operations. Ashing is done with wet pumice; polishing with special compounds containing wax and sometimes a fine abrasive; buffing is done in much the same way.

For larger pieces and some small parts requiring an extra fine surface finish, hand polishing or wheel buffing is necessary. The correct wheel speed for phenolics and ureas using a 10 in. to 12 in. diameter wheel 4 to 5 in. wide is approximately 2,500 r.p.m. A speed of approximately 1,500 r.p.m. is used for styrenes and acetate materials. It is desirable to work with manufacturers of polishing supplies, as a certain amount of experimenting is necessary, depending upon the material used and the design of the part, to determine optimum speeds for different compositions and different wheel constructions.

Articles molded from vinyl plastics can be buffed and polished with fabric wheels of the standard types. Precaution must be taken so only light pressures are used on the work. If the pressure is too great, sufficient heat may be generated to soften the stock and to cause sticking to the fabric wheel. For general purpose work, a muslin wheel with 1½-in. sewing, operating at 3,700 surface ft. per min. may be used. Where appreciable amounts of stock are to be removed during a polishing operation, particularly for the removal of wheel or machining marks from unfilled compounds it is best to use a cutting compound on a loose cotton wheel operating at approximately 6,100 ft. per min.

If the polishing operation can be performed wet, good results are obtained with a suspension of finely divided pumice in water and a loose muslin wheel operating at a peripheral speed of approximately 6,100 ft. per min. A constant stream of water and pumice fed to the wheel produces the best results. This operation is similar to the "ashing" commonly used in the polishing of all plastics, and is the most effective way of obtaining a good surface luster on a production basis.

For laminated phenolics, grinding or sanding with No. 220 grit, cotton buffing wheels, with Tripoli or other polishing compounds, will restore luster. Buffing without prior sanding can be done with Tripoli to restore surfaces which have not been scratched too deeply in handling. Tumbling in pumice and then in polishing compounds is often done on small plastic parts as a substitute for, or as a supplement to, wheel ashing and polishing. Tumbling is also done extensively to remove thin fins. As a rule, tumbling is done dry, but for cutting-down with pumice and for subsequent polishing on acrylics, tumbling is usually done with wet pumice.

FORMING PLASTICS

Thermoplastic sheets and cast phenolic sheets can be formed by heating and stretching over forms. In the case of cast phenolics, the sheet is heated to 180 F. in hot water, placed over the form and allowed to cool. Thermoplastics such as methyl methacrylate and cellulose acetate are generally heated to the range of 220-300 F. Time of heating may range from 4 to 20 minutes. The sheets are hung vertically in an oven.

Power required to form is less than that for soft metals. The heated material is handled like a sheet of gum rubber and about the same power is required to stretch it. For simple shapes the weight of the sheet is usually enough to stretch it. Tolerances of plus or minus 0.125 in. can be maintained in most forming operations.

FORMS

Since the forms are not subjected to much pressure they may be plastic, plaster, wood Masonite or metal. For simple two-dimensional bends, metal, Masonite or plywood forms are easily made; for more complicated shapes, plastic and plaster forms are easier to make and entirely satisfactory. It is usually advisable to reinforce the plaster with wire and to use strips of metal at the edges—especially for stretch forming where there may be considerable pressure on the edges.

The form should be somewhat larger than the finished piece. This permits the use of slightly oversize sheets, which simplifies handling and compensates for the slight tendency of the acrylics to curl away from the form and to flare at the edges. It is helpful to mark a trim line on the form, indicating the limits of the finished piece.

The form should be free of waxes and other variations in contour that might cause optical distortions. The surface should be sanded smooth and covered with soft cloth (such as billiard felt, outing flannel, or imitation chamois) or flocked rubber or suede

rubber sheeting. Forms should be kept clean and brushed off before each piece is formed.

In many cases, pieces can be best formed by using a hold-down ring of yoke, fitted to the mold but allowing for the thickness of the sheet between the mold and the ring. This ring should be hinged or otherwise attached to the form so that it will fit exactly when pressed down on the hot sheet. Stops should be arranged to prevent the ring from being forced into the material when pressure is applied. This hold-down ring may be the exact size and contour of the piece, so that when cooled the piece may be scribed, on the form, around the inside of the ring. Contraction on cooling may be large. The use of a hold-down ring prevents curling away from the form and also permits the use of smaller blanks to obtain the same size of finished piece.

If there are form marks or mark-off on the surface, the sheet should be put back in the oven. It will resume its flat shape—and its original surface except for scratches—can then be formed again. It is more economical to reform several times than to sand and buff out mark-off.

STRETCH FORMING

Many three-dimensional shapes can be made by stretching across a form. The material is heated slightly hotter than for simpler forming, but the surface is allowed to cool slightly, as usual. During this cooling, a number of wooden carpenters' clamps are fastened to the edges, 6 to 10 in. apart. Holding these clamps, a circle of men draw the sheet down around the form. A metal ring can then be clamped in position around the edges.

MALE AND FEMALE FORMING

For three-dimensional sections, especially sections of irregular contour, male and female forms may be used, but the method is not recommended. The hot sheet is stretched across the top of one form, usually the female, and held in position by hand or with clamps while the other form is lowered into place. In this method, a long cooling time is required because heat does not dissipate quickly. Both sides come in contact with mold surface and are subject to mark-off.

TOOLING WITH PLASTICS

Aircraft manufacturers have done extensive research on use of plastics for tooling. At present this use falls into three main types: forming dies, piercing dies, jigs and fixtures.

Cast resins are extensively used for these tooling applications, because they replace hard-to-get metals, they may be cast to the master part directly with consequent saving in machining, dies are lighter and expert tool makers are not required.

FORMING DIES

A plaster cast mold is made from the original pattern. The mold is lacquered and coated with linseed oil for lubrication, after which a low-shrink thermosetting resin is poured. A core is generally used, so that wall thickness of the die can be kept down to about two inches. Thus curing is accelerated. The die is oven-cured for a period of hours, time and temperature depending on the plastic used. Shrinkage occurs and must be compensated for on the pattern.

Plastic molds are made by pouring the casting resin over a pattern that has been treated with a parting medium and then baking the plastic.

Wood or metal molds are prepared by the regular methods. They are generally more expensive, but have better dimensional stability.

Rubber molds may also be used, particularly when many undercuts must be produced. They can be made by electroplating rubber on the pattern or by painting on the latex.

Resin, accelerator and filler must be weighed very carefully before mixing. Manufacturers' recommendations should be carefully followed, as to mixture, temperature at mixing, and procedure. After the proper steps have been taken the resin mix is allowed to remain a few minutes to eliminate air bubbles. It must be poured within 2 hours of mixing.

Curing cycles depend on the volume of the resin, amount of catalyst, and the thickness and heat transfer characteristics of the mold. A general rule is castings less than 10 lb. bake 8 hours at 140 F after standing at room temperature for 4 hours. Castings over 10 lb. are let stand until they become opaque and are then baked at 140 F for 8 hours.

PIERCING DIES

Templet piercing dies are made directly from templets. Outstanding feature of the development is use of laminated plastic backing plates with a thin facing of steel. Maximum stock thickness that has been pierced by this method is 0.102 for ST aluminum alloys and 0.065 in. (16 gage) stainless.

Backing plates are sawed from ½-in. laminated stock. Steel punch and die plates are attached to the backing plates with ½ in. countersunk machine screws 6 to 8 in. apart. 16 gage annealed 1010 is a satisfactory material for punch and die plates.

JIGS AND FIXTURES

Both thermoplastic and thermosetting materials are used for plastic jigs and fixtures. The plastic is cast directly from the master part, whose sides are built up to allow for proper thickness.

In drill jig plates, bushings cannot be cast directly in the drill plate. Bushings are located by casting Cerromatrix around the bushings, which in turn are located to the master part of the templet by means of pins. Oversized holes are drilled in the plastic plate to fit the bushing and Cerromatrix.

Router blocks, shaper blocks and saw jigs can be cast to a contour, and in addition are resistant to the soluble oils used in part fabrication.

TABLE IV—TYPICAL PROPERTIES OF CAST RESIN *

	Original bake 8 hrs. at 140F	24 hr. at 14F	After Bake 1 week at 140F	2 weeks at 140F
Shrinkage from mold dimension, in. per in.	0.0045	0.0046	0.0049	0.0052
Rockwell Hardness R scale	118	118	116	118
Flexural strength, lb. per sq. in.	6,000	6,000	9,000	9,000
Modulus of Elasticity x 10^6	5-7	5-7	5-7	5-7
Impact Strength, Izod, ft. lb. per in. notch	0.326	0.190	0.146	0.146
Compressive Strength, lb. per sq. in.	15,000	15,000	20,000	20,000

*Material: Durez 7421 + 4% 7422.

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Methods for Cutting Aircraft Sheet Metal—I

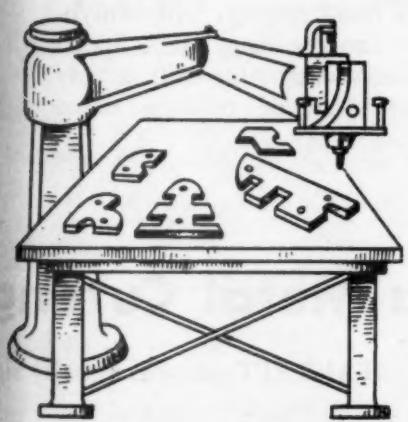
Courtesy Douglas Aircraft Company

EVERY SHEET-METAL PART for aircraft has some cutting operation performed upon it. The problem in obtaining economical and rapid production is to design a part that can be cut on one machine and with one operation if possible. Bend reliefs and notches are the most frequent violations of this rule, but care should be used to lay out these cuts with relation to others on the part so that all cutting operations can be handled at one machine.

If this precaution is not followed, time and money are lost every time materials must be transferred to other machines or other departments. Important losses in toolroom time are a consequence of making up separate jigs and fixtures for the additional cuts.

Consideration must also be given to adapting the part to manufacture on the most efficient type of production machine. The probable volume of parts affects the decision. Comparative efficiencies of seven types of machines are listed, together with their limitations for cutting various metals.

ROUTING



Trims stacks of sheet metal to desired shape

Machine Efficiency

A=Excellent B=Good C=Fair D=Poor

Number of Parts	Cost	Speed	Accuracy
1-5	B	B	A
5-50	A	A	A
50-500	A	A	A
500 & up	A	A	A

NOTES:
Set-up cost—Low
Templet cost—Low
Operating cost—Moderate

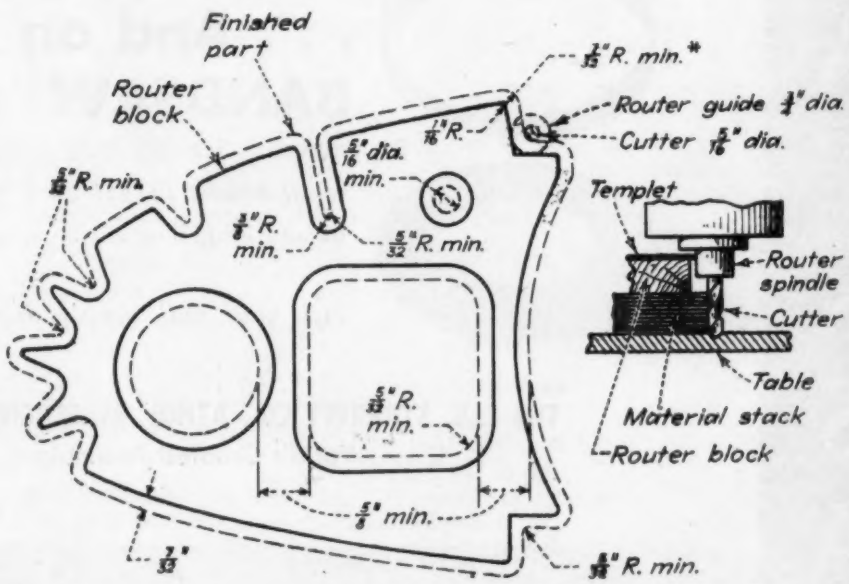
Materials Cut

Aluminum, aluminum alloy, magnesium alloy, copper, and other "soft" metals may be cut.

Corrosion-resistant steel ruins most router bits, therefore may be used only in special instances.

Design Considerations

1. If any cutting operations must be done on router, entire part should be adapted for router (see drawing).
2. Routing is more expensive than straight shearing and/or punch press notching where punch dies are on hand. However, routing is least expensive method of blanking large or complicated shapes.
3. If large numbers of small plants are to be made, consider possibility of combination punch-press blanking and forming.



Router Block Limitations

* NOTE: Absolute minimum = 7/32" R. Recommended 9/32" R. eliminates sharp corners on router block

STARRETT HACKSAWS

The STARRETT Name on a HACKSAW

has extra significance in times like these when there is no time to take chances on the quality and uniformity of blade performance. Blades bearing the Starrett name or label must uphold the reputation of the "World's Greatest Toolmakers."

Whatever the job calls for—Standard Steel for hand sawing, S-M Molybdenum for fast cutting, long lasting power or hand sawing, High Speed Steel for power sawing of extra hard alloy steels—ask your mill supply distributor for blades that are back of—and backed by—the name STARRETT.

. . . And on a Metal Cutting BANDSAW

the STARRETT name is equally significant. Starrett hard tooth, flexible back Bandsaws are made in 10 widths (3/32" to 1"), 3 gauges and 8 pitches — in coils of any length or cut to length and welded, ready to use.

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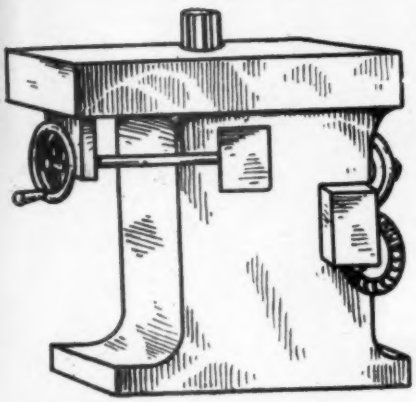
Methods for Cutting Aircraft Sheet Metal—II

PROFILING



Specialized routing machine for trimming edges of formed sheet-metal parts.

Machine Efficiency

A=Excellent B=Good C=Fair D=Poor

Number of Parts	Cost	Speed	Accuracy
1-5	B	B	A
5-50	A	A	A
50-500	A	A	A
500 & up	B	B	A

NOTE:
Form block cost—Small
Set-up cost—Slight
Operating cost—Moderate

Materials Cut

Aluminum, dural, magnesium, and other "soft" metals, but not corrosion-resistant steel, and inconel.

Limitations

Only limiting dimensions are:
Max. thickness of material—1/4 in.
Min. size inside radius cut—1/8 in.

Design Considerations

Most accurate method available for trimming irregular edges of formed parts.

PROPERTIES OF MATERIALS

Aluminum (2SO, 3SO)

Adaptable to plastic forming operations, including severe drawing. Has good ductility and good malleability. Does not have great strength, nor can it be heat-treated.

Aluminum Alloy

Soft (17SO, 24SO)

Similar to aluminum but will not stand as severe cold working. Good malleability but poor ductility. When heat-treated, qualities approach but are not equal to those of hard stock.

Hard (17ST, 24ST)

Stronger, and has greater resiliency (springback) than soft stock. Elongation properties approximate those of soft stock, but this material has poorer ductility and malleability.

Magnesium Alloys

Soft (A or SO)

More brittle than aluminum alloy, and therefore it must be formed at elevated temperatures (350-750 F.). When heated to these temperatures, the forming properties are similar to aluminum soft stock.

Hard (H or SH)

Very difficult to form when cold because of tendency to split. May be formed at elevated temperatures (350-750 F.), but insufficient information is available to predict forming ability.

Corrosion-Resisting Steel

Fully Annealed

A corrosion and heat-resistant metal, having good elongation and forming qualities. Has tendency to work-harden, and may require re-annealing. Fair ductility, but poor malleability.

1/4 Hard

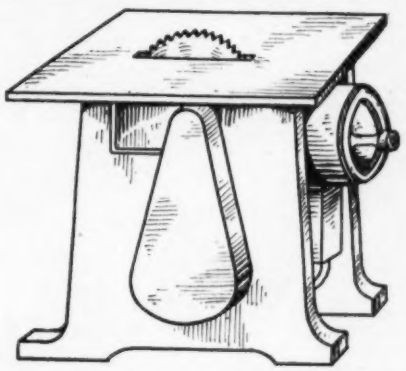
A corrosion and heat-resistant metal, having great tensile strength but poor malleability and ductility.

Full Hard

A corrosion and heat-resistant metal, having high impact and tensile strength, fair elongation, but poor ductility and malleability.

(To be continued)

SAWING



There are several types of saws, all used for cutting such parts as cannot be sheared.

Machine Efficiency

A=Excellent B=Good C=Fair D=Poor

Number of Parts	Cost	Speed	Accuracy
1-5	A	A	B
5-50	A	A	B
50-500	A	A	B
500 & up	B	B	B

NOTE:
Set-up cost—Slight
Operating cost—Moderate
Part must be filed or burred after sawing

Materials Cut

All metals may be cut on one of several types of saws available within thickness limitations indicated below.

Limitations

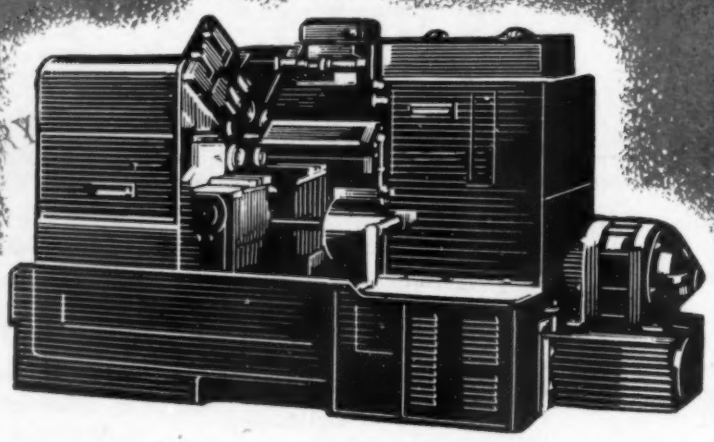
Material	*Max. Thickness**
Aluminum & Dural	3"
C.M. Steel	3/8"
Cor. Resist. Steel	3/8"
Inconel	3/8"
Magnesium	3"
Minimum practical radius	1 1/2"

* Single thickness or stacked material.

Design Considerations

By means of various types of saws practically all types of cuts may be made in all commonly used metals.

1 JOB



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ARMY E NAVY

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Manpower Poses a Problem

MANPOWER is declared to be our No. 1 headache in war production. If we had more workers, says the government, output would rise to new heights quickly. Without those extra workers, we can't expect to go much higher.

In the same breath, Washington puts in front of us certain facts that suggest remedies other than merely adding to present factory forces.

Absenteeism in shipyards is averaging around 12 percent. Among ship welders it is in some places at 25 percent. And welding is the bottleneck in shipbuilding today.

In certain war industries the "quit" rate is 8 percent a month, or almost 100 percent a year. Since a portion of the employees are reliable and stay on the job, the "quit" rate among the remainder of the force is much higher than the figures quoted.

The turnover of workers in a war industry in one of the most important production centers is 35 percent a month.

A leading war industry must employ five men to secure one man who will stick. The other four pick up and leave soon after they have been hired. This is a low production return, any way it is viewed.

A high official privately voices the opinion that if the boilermakers' union would relax its rules that now tend toward restriction of production, millions of manhours would be saved.

In one vital production spot labor has slowed down its efforts. Its output is lower, but it is hard to pin on the man a charge of participating in an organized slowdown.

Because of the uncooperative attitude of the workers in one key company in a key industry, production has been stifled and never has remotely approached the schedule that the government had set up for it.

And so the testimony piles up into impressive evidence that something is wrong somewhere. With all of these things happening, it becomes obvious that we are not getting from our present working forces the output that we should.

If workers would dismiss all other thoughts except one—giving every ounce of energy to producing war goods for our men overseas—it is not unreasonable to expect that our production would shoot up 20 to 25 percent above all previous figures without adding a man to present payrolls.

How to get that extra 25 percent—or even 10 percent—poses a vexing problem. Perhaps it can't be done, since the nearest fighting front is over 3,000 miles away. But it is worth trying.

It is a challenge to union officials to put on the heat and demonstrate that they mean business when they say that organized lazor is wholeheartedly behind the war effort.

It is a challenge to management to conduct its relations with its employees so that they will want to work regularly and hard to make war goods for Johnny Doughboy.

It is a challenge to the government—a government that is often referred to as a "labor government"—to use its authority and prestige and collective wisdom and courage to influence American citizens in our factories to do a still better job.

To look around for more men is not the only way, and not the most intelligent way, to help solve our manpower problem.

Burnham Finney

Gaging Business

War production is continuing to edge upward under terrific pressure from Washington, though not advancing at the rate desired by war officials. Since military strategy is tied in closely with production, the result is likely to be some delay, possibly a matter of weeks, in carrying out certain war campaigns, particularly in the Pacific.

Washington is questioning whether total output of war goods can be increased importantly beyond current levels. Manpower still is the snag; with few exceptions, there is plenty of everything else.

Inefficient use of manpower looms as more responsible for production limits now reached than merely lack of enough workers. There is a wide range in output per manhour of the same products in various plants. In one war industry the "quit" rate in the chief manufacturing area the past year was 38 percent of all those hired.

Reconversions from one war product to another, particularly from ordnance and machine tools to aircraft and shipbuilding, are being accelerated to use all possible facilities where they are presently needed most.

As the campaigns in Europe, especially in Italy, progress satisfactorily, the Pacific is rapidly developing into a major theater of action and the Pacific Coast area will become of greatly increased importance as a center of war manufacture. That area still must have 260,000 more workers than at present to meet production commitments.

CMP is reported working well. Only in isolated cases are serious shortages of materials expected. Principal cloud on the steel horizon is a possible future shortage of scrap to maintain operations at 100 percent of capacity. Alloy steel production now is in balance with demand, which is roughly a million and a quarter tons a month.

Steel castings output, held down by lack of sufficient labor, continues a main source of worry. Improvement is noted in production of aluminum extrusions and forgings. Considerable amounts of extrusions are currently going into stock.

Requirements for electronics equipment are growing so rapidly that demand in 1944 is expected to be 30 to 40 percent greater than this year, total production rising to some $4,000,000,000 annually.

The downward trend in machine tool sales and production is unabated. Severe rules set up by WPB for screening war contractors' requests for permission to buy machine tools are resulting in cutting actual orders placed to the bone. The industry feels that these restrictions have gone beyond reasonable bounds, having been imposed in the first place for the laudable purpose of putting to work hundreds of idle new machine tools now in contractors' hands.

New war needs for machine tools will be substantial, though far less than the unprecedented volume of the past two years. Operations in the industry will be extremely uneven. Builders of special-purpose equipment will be more active than makers of general-purpose tools.

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West Coast Plan To Place Workers Where Most Needed

Dual-committee referral plan is designed to bring work and workers together to the advantage of the war program. Labor priorities will be established to aid referral

WASHINGTON—As Congress gets back into routine, Washington and industry are for once agreed on the nature of the nation's No. 1 internal problem. This does not mean that there is an eye-to-eye view on what must be done, but the recognition that manpower must now be our prime concern is well-nigh universal. The last of the dissenters, who have been maintaining that labor shortages were only a series of local problems, apparently came into line when the parlous state of West Coast aircraft production called forth a joint Army-Navy-War Production Board-War Manpower Commission manpower program, just one step short of national service.

Not only because it marks the official acknowledgment of our manpower crisis, but because—until we get a national labor draft through either law or decree—facsimiles of it are going to be installed in other production centers, knowledge of how the West Coast plan will operate is of importance to all employers.

Authority for administering the West Coast plan, the object of which is to utilize every available worker at the point where he will make his maximum contribution to the war effort, is vested in two committees. One of them, the Area Production Urgency Committee, is responsible for recommending alterations in the military procurement program and in civilian goods production, and will set up a system of manpower priorities and allocations in collaboration with the second committee, called the Area Manpower Priority Committee. Representatives of the Army, Navy, Maritime Commission, War Manpower Commission, War Production Board, War Food Administration, Aircraft Resources Control Office, Office of Defense Transportation, and other federal and community agencies concerned with manpower make up the personnel of these committees.

Hire Through USES

The basis of the program is the so-called "controlled referral plan." This provides that all establishments and services in the areas covered which are entitled to hire workers shall select them only from those referred by the United States Employment Service. Workers will select employment only from among those jobs to which they have been referred. Only rarely, according to USES officials, will a job seeking worker have only one employment opportunity. The Employment Service will usually put him in touch with three or four from among which he can make his own choice.

Similarly, the employer is not obligated to hire any particular individual. He still has the right to pick and choose his own personnel—though only from among those offered him by USES. Referrals of available workers will be made to plants on a priority basis, each firm's priority to labor having been established by the Area Manpower Priority Committee on the basis of information about the relative importance to the war effort of the product coming out of each plant.

Necessary civilian goods plants and services will also get priority rankings and if any firm hesitates about going along with the program, USES will not hesitate to declare it "open game" and start referring employees in that establishment to other employers with higher manpower ratings.

Production Gets Contracts

If the plan proves to be too little or too late as a remedy for Pacific Coast manpower ills, Washington has announced that excess contracts will be switched to other parts of the country. Also, if any item in the overall munitions producing program will be required in smaller lots than present orders call for, California, Washington, and Oregon establishments are at the top of the list to lose the business. A hint to the order in which they will lose contracts is provided by the approval given by WPB officials to the proposal of Henry J. Kaiser who has suggested that firms showing the highest output per man hour have first crack at new contracts. Conversely this would mean that firms having the lowest output per man hour would be the first to have contracts cancelled.

The West Coast plan is being inaugurated in San Francisco, Los Angeles, San Diego, Portland, and Seattle. From these five centers it is expected to spread, first up and down the coast, then inland.

Congress Expected to Clarify and Alter Renegotiation Law

WASHINGTON—Indications are that the tide is beginning to flow in the direction of Business, insofar as the lawmakers' mood toward renegotiation is concerned. After hearing leaders from various lines of business present their stories and arguments before the House Ways and Means Committee, learning of the bankrupting chunks the renegotiators have hacked out of contractors' profits and reserves, and considering the claimant agencies' habits of renegotiating back moneys for further program expansion, congressmen may be expected to legislate the whole procedure into channels more under their control and more to the liking of business.

Congressmen Favor Reserve

Members of the House Ways and Means Committee have already expressed their favor of allowing industry to keep a reserve from profits for purposes of reconversion and resumption of business after the war. Further, there appears a likelihood that law revisions will require price adjustment boards to make public record of their findings, thereby opening the way for judicial review.

While committee members seem impressed by the situations of industries which are busily consuming their future markets, it does not appear likely that theirs will be singled out for favor. Instead, consideration will be given to allowing a flat percentage on gross of 1943 contracts, which would be exempt from renegotiation.

NMTBA Recommends Amendment

Renegotiation after taxes, consideration of war expendability of a company's product, and consideration of saturation of postwar markets have been suggested by the National Machine Tool Builders ssn. as necessary changes in the renegotiation law. The proposals, originally prepared in booklet form, were presented before the hearing by Thorvald S. Ross, president of Rivett Lathe & Grinder Co., who spoke for his own company and for the NMTBA.

The need for these changes results from four critical problems which remain unsolved when the machine tool builder appears before a price adjustment board, the proposal points out: "1. Because of his large increase in volume by comparison to the prewar tax-base years, he is subject to an excess profits tax higher than that of

many other manufacturers; 2. Now that Defense Plant Corp. business is included under war contracts, the percentage of business which will be construed by the boards as subject to renegotiation will be higher than for a manufacturer in most other industries; 3. He has sold out his market for the next 10 or 15 years—where many other manufacturers are looking forward to enormous postwar demand; 4. Competition of war built machines in the new machine market already has begun."

NAM Asks Clarification

In an earlier appearance before the committee, E. O. Shreve, chairman of the subcommittee on government contracts, National Association of Manufacturers, and vice president, General Electric Co., recommended: 1. Provision of a more positive definition of the area of the responsibility of the price adjustment boards; 2. Continuance of the "authority of the procurement agencies to enter into voluntary 'price adjustment' agreements in cases where reasonable prices cannot be ascertained in advance; 3. Effective January 1, 1943, to leave to the tax structure the recapture of past profits."

During the hearings, J. F. Lincoln, president, Lincoln Electric Co., advocated "that the products which were made in peacetime and in which open competition had determined the price, and that price had been fixed by OPA, be eliminated from renegotiation."

Walter Harnischfeger, president of the Harnischfeger Corp., urged repeal of the renegotiation act and the visualization of the problem in its two categories: "One being a procurement problem and the other one of raising revenue—or taxation. If the present revenue act does not siphon sufficient profits from industry," amend it.

Report Favors Government Postwar Aid Over Gathering of Surplus

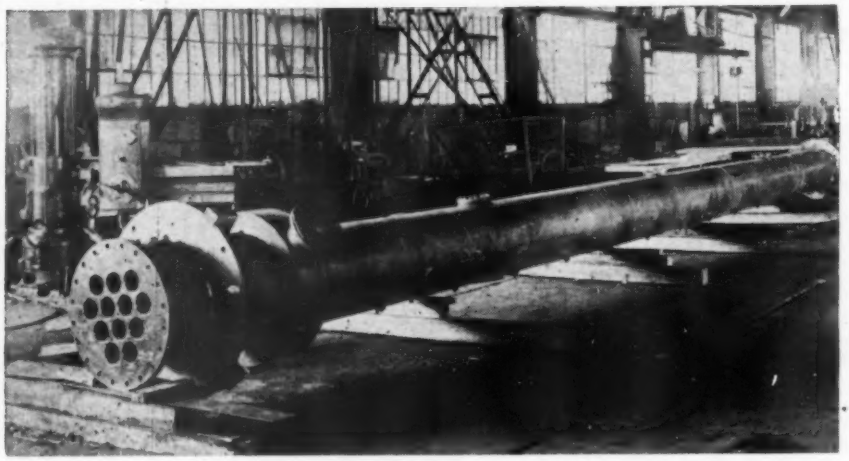
WASHINGTON—Governmental reconversion aid and assumption of contract termination costs, rather than allowing contractors to amass their own reserves against the costs of returning to peacetime production, are favored in the tentative draft of the report by Representative Vinson, chairman of the Naval Affairs Committee. The report is looked upon as the beginning of a move to reassure private industry.

The report, which has yet to be adopted officially by the committee, recommends that termination agreements provide for the charge to the government of severance pay to employees whose employment would terminate with cancellation of government contracts, and for immediate reimbursement to the contractor of the cost of stockpiles which have been reasonably accumulated.

It recommends that the government pay the full cost of reconversion to a contractor who has to convert his plant from peacetime production and who desires to reconvert but is unable to do so without financial assistance or undue loss.

The report recommends amendment of the tax laws to provide for payment to the contractor of the postwar credit due him under operation of the present excess-profits levy, immediately after cancellation, where such payment is necessary to carry his business through the adjustment period.

Immediate steps by Government agencies "to make the necessary plans upon which the postwar economy will necessarily rest and to make available to industry those basic facts by which their own postwar plans must be guided," were proposed. "A great deal of the uncertainty that exists concerning the period of postwar adjustment is directly related to the failure of procurement agencies of the Government to enunciate their policy as to the treatment of contractors upon the termination of their contracts," said the report, criticizing the omission of these agencies in this respect.



Long Range Accuracy—To produce a vessel 50 ft. long, no plus, no minus, and with twelve 4 in. flues welded in place at 90 deg. plus or minus one minute of center line, Leader Iron Works used a Hobart 600 amp. arc welder with 5/32 in. electrodes, made vessel in seven courses, each turned up square on centers in a lathe and beveled 30 deg.

Postwar Employment Survey Being Conducted by D. of L.

WASHINGTON—Postwar employment possibilities in the machine tool industry will be approximately 20 percent of the present level, is the informal opinion of a conference group recently called together to consider a portion of a nation-wide survey being conducted by the Bureau of Labor Statistics, Department of Labor.

Opinions have been gathered by economists working in the field and contacting topside executives of management and labor. Then, in informal conferences with leaders of a specific industry, these findings are considered and evaluated. A recent conference of machine tool people included Ralph E. Flanders, president, Jones & Lamson Machine Co.; Tell Berna, general manager of National Machine Tool Builders Assn.; George H. Johnson, director, WPB Tools Division; Florence Thorne research director, AFL, and Harvey Brown, Intl. Assn. of Machinists.

Plan Extensive Survey

Similar procedures are expected to be followed in possibly 90 different industries. Already over 350 interviews have been conducted in the field, and economists on the West Coast and in the South are interviewing executives and contacting governors' postwar planning committees. It is expected that the survey and report thereon will be completed about the end of October.

In the recent machine tool industry conference, the possibility of tool builders turning to the postwar manufacture of end-use products was considered and discounted; it was pointed out that in most instances such a conversion would be but to crowd a field that is already overproducing itself. As for shipping surplus machine tools to replace war-damaged ones in Europe, it was pointed out that but one-half of one month's production would be necessary to replace every machine tool in Italy, and that such equipment is so heavy, it is rarely destroyed by bombing. Fires have been found to cause the most damage to machine tools.

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Inside Detroit

The automotive industry is quietly preparing for peacetime production, while gorging on aspirin due to the headaches of renegotiation and termination. The Truman committee is accused of politics and of hindering production

Plan Peacetime Automobiles Automobile makers are not saying anything about it publicly, but they already are in the practical phase of their postwar planning. They are quietly surveying the physical state of their plant equipment and are seeing what they must have as a minimum to get back into the manufacture of motor cars when Washington will give the nod.

Are Asking Equipment Bids They are going even a step farther. They have dispatched hundreds of blueprints to the home offices of machine and equipment builders and have asked for firm price proposals on specified types of equipment for certain jobs. These proposals are to be in the hands of automotive companies on designated dates instead of being left to the indefinite future.

It obviously is impossible for an automotive company under today's conditions to place an equipment order intended for postwar purposes and have that order filled. It can, however, place an order conditionally with the understanding that it will be acted upon by equipment builders as soon as it does not interfere with war requirements and as soon as the government permits. Such orders cannot officially be accepted by builders, nevertheless they will be at the head of the list when peacetime business is resumed. Automobile makers are past masters in the art of putting pressure on suppliers to see that they get preferential treatment.

Taper From War To Peace Output But that isn't all. One of the important automobile companies has a well-laid plan for asking Washington, presumably WPB, for permission at the right time to place machinery and equipment orders and have them filled, though the war with Germany may not be over. The right time will be when raw materials and manpower are available for other than war purposes. That time may be next spring or next summer or even sooner.

Company officials have a powerful argument. They point out that equipment builders, such as machine tool makers, are over the hump of their war work and will have the plant facilities and organization to build the desired machinery. If the machinery could be built prior to the war's end or even a respectable start could be made on it, the tooling-up period immediately following the war would be shortened and people could be employed in peacetime manufacture that much faster.

It is believed that this plan, which would speed the retooling of automotive plants as war work tapers during the final period of the conflict, will get a favorable reception in Washington if presented at a time when shortages of manpower and of materials have been relieved.

Expect Autos to Absorb Slack Washington undoubtedly will look to Detroit to spearhead the drive for quick reconversion from wartime to peacetime operations because of the far-flung influence of the automobile industry in employing millions of people, directly or indirectly. Automobile makers envision a lush market for passenger cars the minute that car manufacture will be allowed. Competition will be keener than ever by individual companies to be the first out with new models. The industry guesses that sometime during 1944 authority will be given by Washington to proceed at least on a limited scale with passenger car production, but it may be 1945 before new cars will be in the hands of the public.

No Estimate of Total Orders No authoritative estimate is available regarding the amount of machinery and plant equipment that the automobile industry must purchase to get back into production of cars. It runs into the tens of millions of dollars, however. One company states privately that the percentage of equipment that it can reconvert from war purposes back to motor car manufacture is considerably smaller than the percentage that could be converted from automobile production to war jobs.

Producers Have Worries Twin worries, renegotiation and termination of war contracts, are giving industry here the latest load of headaches. The latter may be termed worrying in advance but nevertheless executives of the larger corporations are viewing it with alarm as the allied armies march toward invasion and victory.

What with growing inventories and obligations, the companies see trouble ahead unless the government allows them to set up some heavy reserves for the day when the cancellations of all war contracts start coming from Washington. So far, the government has been unfavorably inclined to setting up reserves for termination day and has forced the corporations to turn over their reserves as well as the excess profits.

Squeezed Dry To show how this mounts up, one corporation which attempted to hand back $57,000,000 on renegotiation was finally made to give up $69,000,000 instead, the $12,000,000

Quick Stretcher—A stretch press molds aluminum to certain contours in a one-minute operation that formerly required 30 to 40 minutes at Consolidated Vultee's Fort Worth plant, home of the Liberator

Drill Cafeteria— Drill press operators of General Electric's Schenectady Works find this drill holder (left) provides quick selection of the proper drill for the job. Holes in the curved surface accommodate different size drills, and enough space is provided between drills for easy grasping

being its termination cost reserves.

Would Insure Against Loss One manufacturer has a sensible suggestion in lieu of setting up individual reserves. He has broached to Washington the idea of setting up a War Loss Corporation, which will act as an insurance agent for the war plants. Each will deposit a certain portion of its profits against the day when the war work ends and the War Loss Corporation will pay out such portions of the reserve as will be necessary to reimburse the company for its losses.

The suggestion has not been adopted so far. Perhaps it needs a different origin than from a manufacturer. But it appeals to the reasonable person as being a solution to the problem. At least, it is an approach to it.

Say They Make Political Hay Wright Aeronautical's joust with the Truman committee has embittered many automotive and aviation leaders against the group and has brought charges of political maneuvering against the head of the committee and its members.

"I can go into any plant in the country on any day and find things which will get me headlines in the paper," challenged one aviation company chief. "But it won't help the war effort and production. It will sabotage production and that is just what this political maneuvering has done."

Fright Cuts Production Wright is stoutly defended here and its heavy loss of production has been bemoaned. As an aftermath of the Truman attack on Wright, another aeronautical manufacturing company ordered its inspection procedure tightened up, not that it felt there had been laxity before, but to prevent criticism.

ASTE Announces Program of Its Semi-Annual Meeting

DETROIT—The program for the semi-annual meeting of the American Society of Tool Engineers, Indianapolis, October 10-12, has been announced.

Sunday, October 10 will be devoted to the meeting of the board of directors and, in the evening, to chapter officers school.

Monday morning will be occupied by a session devoted to new heat treat techniques, under chairmanship of Robert L. Fitzsimmons, R. C. Atkins Co. The afternoon session, under chairmanship of A. E. Rylander, master mechanic, Midland Steel Products Co., will consider materials handling and plant layout.

Tuesday sessions will be devoted to (morning) gearing, under chairmanship of John L. Buehler, Indiana Gear Works, (afternoon) tooling for the inexperienced operator, with Wendell Macy, Logansport Machine Co., in the chair, and (evening) Allison aircraft engines—their surface finishes and gear manufacturing, presided over by Walter Folger, Allison Div., General Motors.

Urge Standard Threads

WASHINGTON—In contrast to a decline in requirements for other cutting tools, a critical situation still exists in the production of die-hards, chasers and collapsible taps. Problems created by this situation were discussed by the Die-Head, Chaser and Collapsible Tap Industry Advisory Committee with War Production Board representatives.

It was agreed that efforts at standardization should be made in the preparation of all new designs for war equipment. The Ordance representative stated that standard specifications for threads wherever possible on current items are being used.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

BOLTS & NUTS — Manufacturers of these products have been given an option to use MPR 136 in pricing special bolts, nuts, screws and rivets produced complete, or in their first operation, on hand or automatic screw machines. (Amendment 2, Maximum Price Regulation 147.)

ELECTRODES—Use of certain critical materials in the manufacture of spot welding electrodes has been restricted, and simplification and standardization practices have been established. Provisions prohibit the use of tungsten, molybdenum or metallic mixtures containing these metals, except in electrode facings and inserts; and permit use of copper base alloys of cadmium, chrome, beryllium-cobalt and beryllium-nickel to extent specified in Schedule B. (Conservation Order L-318.)

FLANGES — Special formula for pricing cast steel flanges, forged steel flanges and those made from steel plate may continue to be used by qualified manufacturers until Nov. 1, 1943. (Amendment 6, Order A-1, MPR 188.)

IRON & STEEL—Producers may procure capital replacement items up to a value of $2,500. Amended order provides for periodic reports of MRO used by these producers. (Preference Rating Order P-68, Amended.)

MACHINERY REPAIR — Blanket preference ratings assigned for MRO purposes may be applied by persons eligible to use them for repair of plant machinery and equipment, even if job does not involve delivery of repair parts or materials. (Priorities Regulation 3, Amended.)

SCHEDULES—Parts of a product which is subject to a frozen schedule are also subject to the schedule if the parts, as well as the entire product, are made by the same producer. Ruling also applies to parts of a component. (Priorities Regulation 18, Amended.)

VISES—Types and sizes have been reduced from approximately 165 to about 40 types and sizes. (Schedule VI, Limitation Order L-216.)

WRENCHES—Manufacture of certain types of wrenches, pliers and nippers for consumer, previously prohibited, has been permitted. Prohibition on manufacture for a producer's inventory or for a distributor's inventory or shelf stock has been continued. (Amendment to Schedules II and III, Limitation Order L-216.)

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Wartime Washington

Patman bill designed to extend postwar aid to industry and business; would place surpluses in hands of custodian to release as market demands. Legislation establishing termination practices is expected; plans are suggested. Dealers buy surplus

Sell Surplus To Dealers Surplus machinery and equipment is being gathered for sale to dealers under a procedure of sealed bids. Producers, who do not need it for immediate war production, may not purchase this surplus to stack it away for anticipated conversion to peacetime needs; however, they may purchase it from the dealers. There is nothing to prevent dealers purchasing peacetime-production type of equipment at exceptionally low prices and hoarding for price rises with the coming of peace.

In the case of both the sealed bid purchase by dealers and the sale by them to producers, the OPA ceiling of 85 percent for reconditioned machinery and 55 percent for used machinery apply. It has been noted that there is no floor under these sales to dealers, and it is feared that in the plan lies the nucleus of postwar dumping of surplus machinery and machine tools.

Seek to Redistribute Under the plan as it now operates, each claimant agency prepares lists of machinery and equipment which is surplus to each of its contractors, and circulates them among its other contractors for 20 days. Such equipment as they can show a need for is transferred to them, and the unclaimed balance is offered to contractors of other claimant agencies for the 20 following days. A producer may secure equipment by negotiation through the claimant agency with which he is contracting, providing that agency and WPB certify that he needs it to further his war production effort. The price is fixed by negotiation between the contractor and the agency, limited only by OPA's 85-55 percent ceilings.

If at the end of the two 20-day periods certain equipment still remains unclaimed, it is turned over to the WPB Redistribution Division, whence it is offered for sale to dealers through the regional offices Treasury Procurement Department has set up in WPB regional offices. Failing sale within a reasonable length of time, equipment and machinery returns to the original claimant agency for scrapping or reclamation of usable parts.

Custodian for Surpluses A bill introduced by Wright Patman of Texas, chairman of the House Committee on Small Business, would make it mandatory for postwar private industry to employ one disabled veteran for each hundred workers, would freeze all sales of surplus war property, provide for the appointment of a custodian of surplus war property, and permit war veterans to be trained in engineering and other fields at government expense.

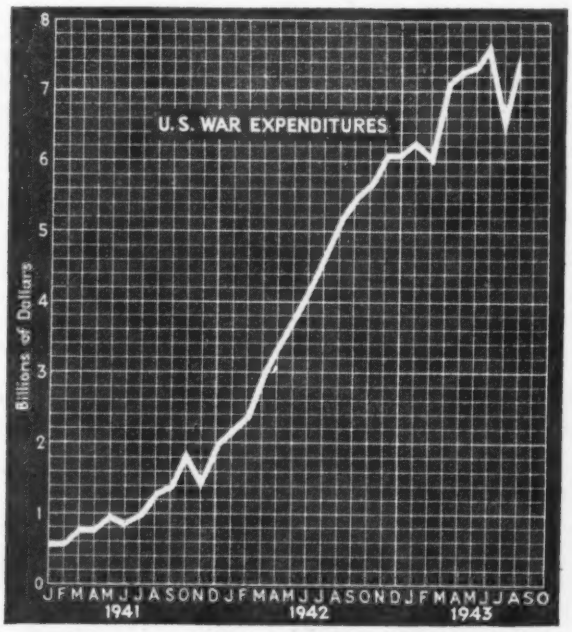
The bill provides that the Smaller War Plans Corporation shall determine to what uses surplus property may be put by small business enterprises, and make recommendations to the custodian. He is authorized, in selling any such property, to extend credit to the purchaser at interest not to exceed 3½ percent per annum.

Designed to Aid Industry The intent, Mr. Patman says, is several-fold: to aid returning servicemen, small business, and the manufacturing industry in general—including makers of machine tools and construction equipment. "The federal government has now in its possession a vast store of materials, tools and plant facilities, which are causing visible alarm in certain circles. It is feared that this vast government stockpile will be utilized to damage existing firms through postwar competition. We do not have the right to destroy or otherwise waste its potential power. Rather than write off the investment involved in this property or let the property go into the hands of firms which are now strong and powerful in their own right, I propose that we create a custodianship to hold this property."

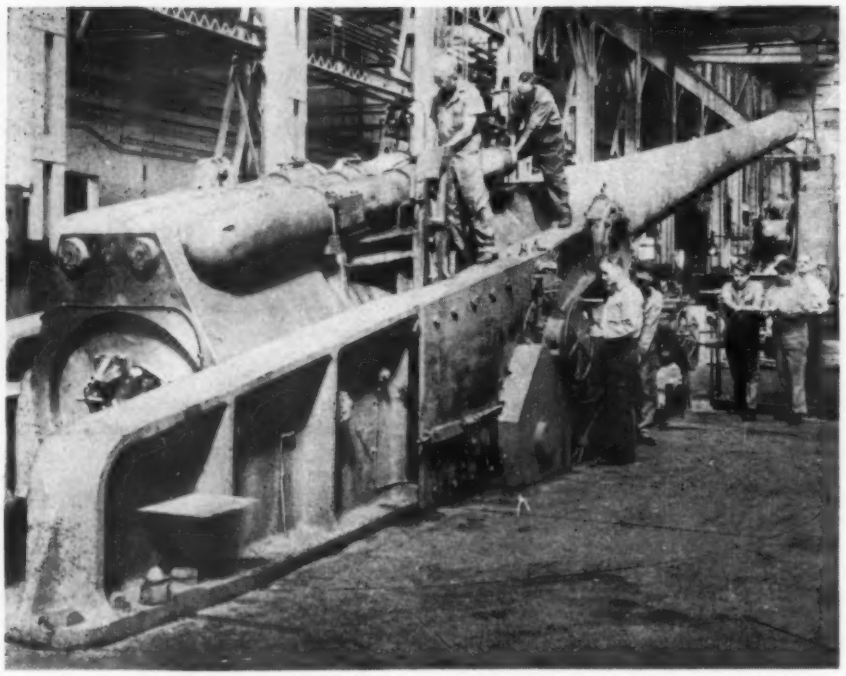
Price setting would be left to the custodian, who would be expected to release property a little at a time, comparatively speaking, so as not to flood the market. Property would be disposed of locally, thus giving the purchaser the advantage of short-haul freight rates. In order to prevent purchasers from buying for the purpose of reselling, the sales contract would provide for sale to users only, would prohibit re-sale within a given time.

May Legislate Termination Ranking high on Congress' calender of prime subjects is legislation to set up procedures for termination and settlement of war contracts. The interest, swelling during the summer recess while dinned into the ears of home state-visiting congressmen, is now further underscored by growing popular belief in the approaching termination of hostilities.

(And speaking of the end of the war—as who wishfully isn't?—War Production Board is losing employees, from all classes of jobs, who feel they'd better get back home to long range peacetime work. If employees of the agency that, but a few short weeks ago, railed against complacency, are sniffing Washington's rumor-laden air



A Prophetic "V"— After dropping sharply from June ($7,688,000,000), to July ($6,746,000,000), August war expenditures spurted sharply upward to a total of $7,529,000,000. This represented an increase of $783,000,000 over July, or 12 percent. Compared to the peak month of June, August expenditures showed a 2 percent decrease. It is thought much of this difference may be attributable to advance and delayed deliveries, and possibly to a rush of end-of-fiscal-year payments in June



Ton Tosser—A gun with devastating firepower that can be directed by a mere flip of the wrist is the 16 in. coast defense rifle, which can hit a 28-mile-away, over-the-horizon target with a projectile weighing more than a ton. The giant barbette carriage, consisting of two cast steel plates weighing upwards of 20 tons apiece, is produced at Wellman Engineering Co.

and smelling Peace thereon, what can you expect of Patrick Pietro Public, who is many miles removed from the inspiring anti-complacency propaganda pool? When it comes to wishful thinking, he's doing it in terms of inventory, equipment and working capital.)

Consider Uniform Clause War Production Board's Procurement Policy Division is trying to formulate a uniform termination clause. It's been written and re-written for more times than some WPB orders have amendments.

Legislation Has Been Offered Senator James Murray has introduced a bill which would cover all contracting, providing mandatory advancements to contractors and subcontractors of not less than 75 percent of amount certified by contractor to be due, payment to be made 30 days from time of certification. It provides also for loans in addition to the 75 percent.

Congressman Andrew J. May's bill, introduced at the request of the War Department, gives the Secretary of War a blank check to pay off contractors as he sees fit. Naturally this bill will not be supported by many contractors; they worry about the fitting he might see fit to give them.

Plane Makers Outline Plan Some leading members of the aircraft industry have made known their recommendations. They want legislation providing mandatory advance payments up to 90 percent of the cancellation; authority for contractors to settle with subs up to $25,000; subcontract claims in excess of $25,000 they would turn to the government for advances up to 90 per cent; reimbursement of termination expenses, such as unexpired leases; severance compensation for employees; the procurement agency having predominant business in the plant should settle for the others; right of appeal to the courts from decisions of department heads. There is no provision in present regulations or laws for termination costs.

Want Simple, Direct Plan WPB, War Department, the aviation industry and most other industries want legislation to clarify and simplify the procedures that shall follow when Peace rears her beautiful head. Navy and Maritime Commission haven't yet asked Congress to take action, but it is safe to assume that they favor it, too. Most seriously in need of relief are small concerns, subcontractors and sub-subs, who must deal through prime contractors; the farther they are from the source of funds the longer it'll take them to get back the working capital, and the less able they are to wait.

Army and Navy and other claimant agencies have authority to cancel contracts and refund money at their own discretion. But the manufacturers want Congress to say that they *must* pay off and do it immediately, and negotiate fine points later.

Board Appointed to Direct SWPC Work in New England

BOSTON—Admitting that it is impossible for national headquarters to have a working grasp of the problems of filling the open capacity of small plants in the production of war materiel and civilian supplies, General Robert Wood Johnson, chairman of the Smaller War Plants Corporation, has announced the appointment of a regional board of governors to direct this work in New England.

General Johnson stated that New England, the home of small industry, has more available capacity than any other region of the country and that much progress is being made in utilizing this open capacity by Richard C. Cooke, regional director.

Mr. Cooke announced a downtrend in the number of small plants with open capacity in New England. Out of a possible 16,136 plants, covering twenty industry classifications, there were only 1,567 having unfilled capacity as of September 1. These are known as "rated" plants, which means that they are operating at less than two-thirds of their normal capacity.

In the breakdown of these plants, out of 903 producers of machinery other than electrical, 235 are in the "rated" group. Of 207 builders of electrical machinery, 21 have open capacity; of 1,014 makers of iron and steel products such as castings, stampings, forgings and welding, 213 are operating below normal capacity and 130 makers of non-ferrous metal products out of 704 are in the "rated" group.

Board Locates, Coordinates

The work of the new regional board will be to locate plants with specific capacities and skills for needed prime and sub-contracting, and to coordinate existing government agencies right down to procurement of materials and manpower.

While war production will continue to be uppermost in the aims of the project, a great deal of the effort will be to meet essential civilian needs with an eye to postwar requirements.

SWPC HEAD RESIGNS

WASHINGTON—Robert W. Johnson, a vice chairman of the War Production Board and chairman of the Smaller War Plants Corp., has resigned due to ill health.

The retiring vice chairman was named to his post as head of the SWPC as a successor to Lou E. Holland, last January. At the time of his appointment he was a colonel in the Army in charge of the New York Ordnance District. Shortly after joining WPB he was made a brigadier general. Later he resigned his commission to treat with the problems of small business as a civilian.

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Spotting The Air News

With airplanes the proven number one weapon of the offensive, West Coast aircraft plant manpower shortages assume critical proportions. Two new airplanes emerge from development. Rocket planes and electronic controls interest the inventors

West Coast manpower still holds first place among war production problems, but there is less talk because nearly everything has been said. Some remedies are being tried and standby measures are being worked out in case current efforts fail. Washington is taking it seriously; Charles E. Wilson, executive vice chairman of WPB, himself, is on the job, to say nothing of eight or ten other government department heads.

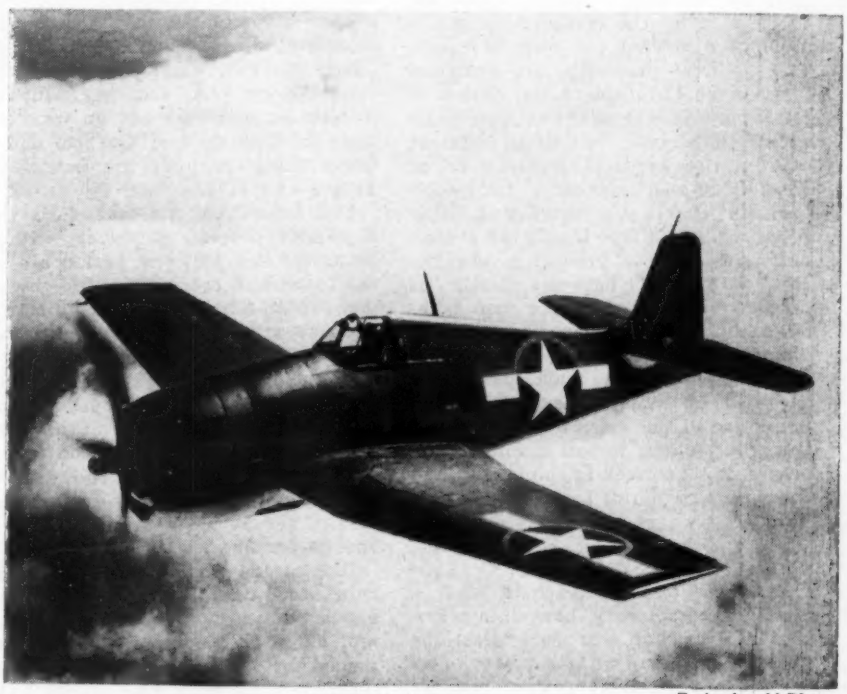
The industry is doubtful but cooperative. Byrnes' "Buffalo" plan is legalistic and confusing to manufacturers. The administration felt it had to take a hand in this major impasse, but the lengthy solution from the Office of War Mobilization might as well have been omitted. Wilson, who spends much time on the coast production front, can follow the text of Byrnes' program, or take whatever other action seems to be indicated. Whichever he does, he is somewhat embarrassed by the fact that the thing was written over his head.

If Wilson doesn't succeed, with the help of perhaps too many cooks in WMC, OWM, WPB, Army and Navy, then the threatened national service act, called for by the War Department, will be several steps nearer. Such a law would enable the administration to order workers wherever necessary, without regard to their wishes. Attempt to pass such a law would embroil the country in controversy. War production agencies were hoping the Army would slack its draft and leave aircraft key men at least, possibly even give back some of those already inducted. But War and Navy testimony against the bill to prevent drafting fathers seems to kill that prospect. At this writing, the limited deferment granted aircraft workers was to expire on October. You can be sure of but one thing. The industry needs about 42,000 men to go on toward its maximum production around next April. Aircraft are the number one weapon in continued victories, and the administration will have to get the workers somewhere.

Two new airplanes, long in development, have emerged to the newspaper headline stage. One is Grumman's new "Hellcat" shipboard fighter, whose Pratt & Whitney air-cooled engine develops above 2000 hp. This fighter adds still more speed and turning ability to the heavy armor and heavy guns which have been this country's policy all along. Grumman also builds the Navy's shipboard fighter "Wildcat," and its torpedo carrier "Avenger." This gives Grumman three star planes in the war, a record not excelled by any other company. Very little can be said about the new Consolidated-Vultee "Seawolf," another torpedo carrier. It fights with a crew of three, and has heavy guns. Aerial torpedo operations are important. High level precision bombing of fixed targets is successful, but hitting ships is much harder. To kill ships on a big scale it is necessary to come in low and close.

Critical speeds, attained by the tips of large propellers and approached by some combat airplanes in dives inspires engineers to keep working on jet propulsion, which, if and when it can be brought under control, can carry men and cargoes aloft without engines, and without wings. (Critical speed, at which air ceases to flow evenly on lifting surfaces, is about 750 m.p.h. Jet propulsion is under intensive study at various aeronautical laboratories in this country. Planes have been flown under "rocket" power, here and abroad. The immediate objective is to use it as auxiliary power in the takeoff of heavily-loaded craft. It has been tried in the propulsion of vehicles and boats. Apparently the first company organized in this field is Aerojet Engineering Corp.

Electronic robot pilots have been holding heavy planes straight and level —approaching the "stable platform" ideal—during bombing runs, it is revealed by the Minneapolis-Honeywell Regulator Co., which has been building them under contract with Army Air Forces. The company cooperated with Army's Wright Field Laboratory in development work. Electronic engineers and readers of the technical press have known of Army and Navy efforts during the past several years to control the flight of un-manned aircraft to enemy objectives. Stabilization of bombing planes during the target run is the first practical use.



Rudy Arnold Photos

Hellcat on Wings—For months a closely guarded secret, the Navy now reveals that its speediest, most maneuverable fighter warplane, the Grumman "Hellcat" (F6F) has gone into action. In the 400 m.p.h. class, it is adaptable to carrier decks, has folding wings to increase carrier capacity and is an all-altitude fighter maintaining spectacular maneuverability to highest combat ceilings

Canada Studies Wage Revisions; Plan Reconversion; Output up

OTTAWA—All Canadian industry is waiting for the terms of an impending revision in the dominion's wage stabilization structure which will substantially advance production costs. Wage ceilings are to be loosened but Prime Minister Mackenzie King's cabinet, after struggling with the issue since early in September, had not settled on a policy before the fourth week of the month.

Inquiry Indicated Need

Necessity for revision arises out of an inquiry commenced in May into disturbed labor relations, involving strikes in war plants and essential services, by National War Labor Board. Terms of NWLB's report, which recommended a program of concessions to labor, produced a split in the three-man board which ended in the government's dismissal of the labor representative. Although the report has not yet been released, it is known that Chairman C. P. McTague, justice of the Ontario Supreme Court, and industry's representative Leon Lelande of Montreal recommended a labor relations plan carrying wide concurrence in demands of labor organizations. These include the alternatives of the lifting of the wage ceiling from workers receiving 50c an hour or less and a family allowance to be paid by the treasury for every child of a worker not over 14 years. The optional proposals are designed to give the government the choice of releasing wages from the ceilings to an extent that would compel adjustment of its price control structure or of subsidizing workers on a family allowance basis and thereby holding price ceilings. The family allowance option would also provide a wartime pay differential between heads of families and single men or men without children. The plan proposes the abandonment of the cost of living wage bonus system, which is tied to the cost of living index (every one point rise in the index over a quarterly period calling for an automatic increase of 25c a week in the bonus) and the incorporation of bonuses now paid into basic wages.

Labor Gets Concession

The plan also concedes to labor a wartime compulsory bargaining system at least for war industries—the government being without power to establish a permanent system because the provinces normally have jurisdiction in labor matters.

Clashing with the majority of the board on the issue of an all-out surrender to demands of labor unions, J. L. Cohen, labor representative on NWLB, staged a three-weeks sitdown strike, refusing to attend meetings of the board. When he proposed to end his strike in order to take part in hearings on wage applications from steel workers, Premier King removed him on an ultimatum from Chairman McTague that the government could choose between himself and Cohen. Meantime McTague and Lelande boosted the basic wages of skilled steel workers in plants at Sault St. Marie, Ontario, and Sydney, Nova Scotia, by 4½c to 6½c an hour to bring them into line with basic wages for unskilled workers increased last March.

Ottawa will adopt the McTague-Lelande report—choosing between breaking wage ceilings and adjusting price ceilings accordingly or maintaining price ceilings by the alternative plan for family allowances. Industry is alarmed by the situation, seeing a tighter wartime profits squeeze in either plan and the laying of a foundatizon for higher labor costs in the post-war period.

Plan for Peace

Canadian industrial leaders are taking a leaf from the book of their opposite numbers below the border and are starting to organize for a reversion to peacetime operations on a scale to ensure full production and employment by private enterprise itself with a view to precluding the necessity of intervention of the state with government-financed, employment-creating undertakings. A Heavy Industries Federation has been set up with sections in Ontario and Quebec, and is undertaking to plan the swing-over at the end of the war.

The federation, however, feels that it cannot proceed effectively without plans for the post-war period are going to be, and it is asking the government to clarify the outlook by setting up a separate ministry of reconstruction. The ministry would devote itself exclusively to post-war matters and take industry and business into its confidence so that private industry could make its own plans conform to prospective government policy. Pressure from industry may bring adoption of the separate ministry plan by the government.

One of the plans of the federation calls for rehabilitation of civilian goods plants by the scrapping of old and out-of-date equipment and its replacement with modern machines and machine tools from war plants which will cease operations at the war's end.

War Output Rises

With the output of war equipment now at the rate of $55 millions a week, 1943 will be Canada's peak year in war production. The weekly output now includes 6 or more ships, 80 aircraft, 4,000 motor vehicles, 450 fighting vehicles, nearly 1,000 guns, barrels and mountings, 13,000 small arms, more than half a million rounds of heavy ammunition, 25 million rounds of small arms ammunition, 10,000 tons of chemicals and explosives and instruments and signal equipment to a value of $4,300,000. Total outlay on war plant and production since the war started now totals $6,500,000,000.

Resigned—Successor

Maurice Karker, left, after 14 months as chairman of War Department price adjustment board, has resigned due to ill health. Joseph M. Dodge has been appointed to the vacancy

Time Cycle Chart

WRIGHT FIELD, DAYTON, OHIO—To offer practical assistance to aircraft manufacturers, in purchasing aircraft alloy steel drop forgings, the Materiel Command has published a time cycle flow chart for these products. An analysis of critical shortages in steel forgings indicated that it was caused largely by a lack of understanding of the time required to produce them. As shown on the chart, an average minimum time of 21 weeks is necessary to produce a typical annealed forging, while heat treated forgings require an average of two additional weeks.

By allowing maximum time in placing orders for forgings, manufacturers will be able to avoid production stoppages, since the 21-week average for annealed forgings, for example, might be stretched to 40 weeks in some cases by delay factors and restrictions at any point in the production of the steel and the forgings.

Set Up Security Award

WASHINGTON—The U. S. Office of Civilian Defense is establishing the National Security Award to recognize industrial plants which have developed superior safeguards against fire, sabotage, accidents, or air attack. Award will be based on thoroughness of preparation and of cooperation with local civilian defense corps.

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NAMES in the NEWS

E. Perry Holder

E. Perry Holder has been elected president of Wickwire Spencer Steel Co., New York City, manufacturer of steel, wire and wire products. During the N.R.A. Mr. Holder served on advisory boards of the laundry machinery, gasoline pump and centrifugal manufacturers. He was executive vice president of American Machine & Metals, Inc., New York City, until 1937. Since 1940 he has been president of Vulcan Iron Works, Wilkes-Barre, Pa., in charge of all operations.

H. T. Kessler, formerly vice president of Tuthill Pump Co., Chicago, maker of rotary pumps for oil burners, coolant, lubricating, hydraulic mechanisms, has been named executive vice president and general manager. Mr. Kessler became associated with the firm early in 1940 as vice president in charge of the freezer sales division. Previous to that he was connected with the electrical refrigeration and air conditioning division of Servel.

Robert G. Glass has been appointed vice president and manager of operations and a director of the Geneva Steel Co., a new Utah subsidiary of United States Steel Corp. Mr. Glass has been assistant manager of operations, Carnegie-Illinois Steel Corp., Chicago district, since 1941.

Robert H. McCracken has become manager of combined sales of the Boston office of Lukens Steel Co. and subsidiaries, By-Products Steel Corp. and Lukenwald, Inc. He was formerly associated with Central Iron & Steel Co., serving for 18 years as Philadelphia district sales manager. For the past two years, Mr. McCracken has been assistant general sales manager at the home office in Harrisburg.

J. J. Topolinski has been appointed works manager of Skilsaw, Inc., Chicago, producer of electric hand saws, sanders, grinders, buffers, drills. He has been connected with Skilsaw 11 years, and until his recent promotion, had been superintendent since 1940.

Arthur R. Brandt, George W. Henyan and V. M. Lucas have been named to new positions in the Electronics Dept. of General Electric Co., Schenecday, N. Y. Mr. Brandt has been made general sales manager and will be responsible for the coordination of sales plans and policies of the several divisions, and the operations of the department's district offices. Mr. Henyan, formerly manager of the Transmitter and Tube Sales Divisions, becomes assistant to the vice president of the Electronics Dept.; while Mr. Lucas has been named manager of the Government Div.

R. C. Griffith has become associated with Denison Engineering Co., Columbus, Ohio, manufacturer of oil-hydraulic equipment, as manager of engineering and research and will collaborate with its marketing division.

John J. Gorrell and C. A. Hartman have joined the metallurgical and engineering service staff of Meehanite Metal Corp., New Rochelle, N. Y. Dr. Gorrell was previously chief chemist of the Pressed Steel Car Co., Pittsburgh and had been metallurgist for the Standard Steel Car Co., Butler, Pa. Mr. Hartman has been foundry superintendent of the Harrisburg Machine Corp., Harrisburg.

A. N. Morton

A. N. Morton has been named vice president and director of Mack Mfg. Corp., motor truck maker, and will continue his duties as production manager of the Plainfield and New Brunswick, N. J. and Allentown, Pa., plants. He has been connected with Mack since the end of World War I when he joined the organization as chief inspector at Plainfield. At the same time announcement has been made of appointment of C. W. Haseltine as vice president. He has been associated with the company for 31 years, and for the past 26 years has been secretary-treasurer, continuing in that capacity in his new position.

William L. Schrader, production assistant to the vice president of Kellett Aircraft Corp., Philadelphia, has been promoted to general factory manager. The company is engaged in manufacturing several types of rotary wing aircraft, including autogiros and helicopters.

B. M. Horter has been named purchasing head of Cutler-Hammer Inc., Milwaukee, electrical manufacturer. He succeeds F. S. Wilhoit who has retired after 41 years of service with the company.

Kenneth F. Cramer has become district manager of the New York office of Baldwin Locomotive Works. He began his association with the company in 1940 as Kansas City district manager for the diesel division. In 1942 Mr. Cramer was transferred to the Chicago office, and since the war has been dividing his time between the Baldwin offices in Kansas City, Chicago and Washington.

Fred E. Harrell, assistant chief engineer of Reliance Electric & Engineering Co., Cleveland, maker of electric motors and speed reducers, has been appointed chief engineer.

Robert T. Keller

Robert T. Keller has been advanced to the position of works manager of the Chrysler Tank Arsenal and assumes charge of all machining, assembling and other tank manufacturing operations directly under E. J. Hunt, operating manager. Mr. Keller has been associated with Chrysler since 1934, and has been working with Mr. Hunt on the tank contract for the past three years. In 1941 he was made assistant master mechanic, and staff engineer of the Arsenal in 1942.

Clarence C. Helmle has joined the technical staff of the Enthone Co., New Haven, Conn. He was associated with the Bridgeport Works of General Electric Co., where he was successively plating analyst, chemist and then head of the inorganic laboratory in charge of electroplating, metallurgy and general chemistry.

C. H. Linder has been appointed assistant manager of the Schenectady Works of General Electric Co. He joined the company in 1924 as a student engineer, and from 1938 to 1942 he was superintendent of the Searchlight & Ordnance and Hydraulic Control Departments.

G. L. Christianson has been advanced to assistant to the general manager of Rockford Drilling Machine Div. of Borg-Warner Corp., Rockford, Ill. Prior to his new appointment, he managed the factory sales department which now handles orders for marine, aircraft and army vehicle parts for the armed services as well as agricultural equipment.

Richard Hammerstein and T. J. Clark have been appointed to the engineering staff of Park Chemical Co., Detroit, platers and polishers supplies, and will be service engineers in the heat-treating division.

E. H. Howell, manager of the Toledo office of General Electric Co. for the past 13 years, has been named man-

ager of the Meter & Instrument Div. S. J. Tombaugh, sales engineer at Cleveland, succeeds Mr. Howell as manager of the Toledo office.

C. S. Shoemaker

Clayton S. Shoemaker has been named eastern sales manager of Dow Chemical Co. with headquarters at 30 Rockefeller Plaza, New York City. Ralph E. Dorland, who has been connected with Dow for many years, will continue as manager. Mr. Shoemaker has been associated with the firm for a number of years, and has held various sales executive positions with the company.

BUSINESS ITEMS

Van Norman Machine Tool Co., Springfield, Mass., has announced a change in its name to Van Norman Co. The purpose of this change is to abbreviate the present corporate name and to eliminate the implication that the activities of the company are confined solely to production of machine tools. In past years the company's activities have been expanded to include automotive service equipment and products associated with the field of electronics, notably induction heating equipment.

Kennametal Inc., Latrobe, Pa., is opening a Philadelphia office and warehouse at 3701 N. Broad St. for direct sale, tool engineering and service in the distribution of its line of tools and tool blanks in the area comprising eastern Pennsylvania, southern New Jersey, Maryland, District of Columbia, Virginia and certain other specific areas. William S. Jones of Kennametal Inc. is in charge of the office. Representation by P. A. Patterson Co. of Philadelphia has been discontinued.

Taft-Peirce Mfg. Co. of Woonsocket, R. I., manufacturer of machine tools, has appointed Austin-Hastings Co., 226 Binney St., Cambridge, Mass., as the company's representative for all of New England except Connecticut.

W. K. Millholland Machinery Co., Indianapolis, has been named sales agent in Indiana, southern Ohio and northern Kentucky for the Watson-Stillman Co., maker of hydraulic presses, injection molding machines, extrusion and carbon presses, accumulators, hydraulic pumps, straightening presses and jacks.

Detrex Corp. is the new firm name of Detroit Rex Products Co., Detroit, producer of degreasers, washers, cleaners, degreasing solvents and cleaning compounds.

Carbide Tool Co. of Chicago has renamed its principal division the Lake Shore Tool Works and will devote this Chicago plant to the production of all types of special cutting tools.

John S. Barnes Corp., maker of pumps, controls, fluid power units, of Rockford, Ill., has opened an eastern sales office at 2003 Fisk Bldg., New York City. E. C. Hawkins, formerly chief engineer of LeMaire Tool & Mfg. Co., Detroit, is in charge of the office. The company has also annuonced the appointment of Henry G. Hoss, 4301 Park Ave., Indianapolis, as sales representative for Barnes hydraulics in Indiana.

K. H. Huppert Co., maker of electric furnaces for industry, has recently moved into its new building at 6830 S. Cottage Grove Ave., Chicago.

Rudel Machinery Inc., New York City, and Swind Machinery Co., Philadelphia, have been appointed agents for Ohio Crankshaft Co. to handle its line of Tocco process induction equipment.

C. O. Bartlett & Snow Co., Cleveland, manufacturer of foundry, sand handling and conditioning equipment, dryers and other heat processing equipment, has named Martell & Ferree, 1505 Race St., Philadelphia, as sales representatives in that territory, comprising Delaware, southern New Jersey and eastern Pennsylvania.

OBITUARIES

William O. Ingle, 68, for many years vice president and treasurer of Consolidated Machine Tool Corp., Rochester, N. Y., passed away after a short illness. Besides his wide acquaintance in the machine tool industry, Mr. Ingle was nationally known for his work with the Rose Society.

Joseph W. Ricketts, a pioneer automobile manufacturer, died in Miami, Fla., at the age of 67. He was credited with a number of improvements in the automobile, including a workable differential.

John R. Taylor, chief engineer of Allegheny Ludlum Steel Co., Pittsburgh, passed away at his home in Tarentum at the age of 56.

William E. Jewell, retired superintendent of Inland Steel Co., Chicago, passed away after an illness of one year. He was 73 years old. Mr. Jewell had been connected with Inland for 33 years, and was past chairman of the Chicago Chapter of the American Institute of Mining & Metallurgical Engineers.

Paul Hoffman, 61, consultant and formerly chief engineer for Ingersoll-Rand Co., machinery manufacturer, at the Phillipsburg, N. J. plant, died of a heart attack. He joined the company as a turbine designer in 1912 and became chief engineer in 1932. Mr. Hoffman retained the latter position until 1940 when he became ill.

Niels M. Hansen, president of N. M. Hansen Mfg. Co., Toledo, precision instrument maker, died after a heart attack at the age of 74.

Allan Seymour, Philadelphia district manager of the Abrasive Div. of Norton Co., Worcester, Mass., died recently. He had been connected with the company for 25 years and had been in charge of the Philadelphia branch since 1934.

David Wake Dunlevy, retired president of Colonial Steel Co., Pittsburgh, died at his home in that city at the age of 76. Before becoming general manager and president of Colonial Mr. Dunlevy had held engineering and managerial positions with several other steel firms.

MEETINGS

American Gear Manufacturers Assn. Semi-annual meeting. Edgewater Beach Hotel, Chicago, Ill. Oct. 25-27.

American Machine Tool Distributors' Assn. Fall meeting. Seigniory Club, Montebello, Canada. Oct. 14-15.

American Society for Metals. Annual meeting. Palmer House, Chicago, Ill. Oct. 18-22.

American Society of Mechanical Engineers and Engineering Institute of Canada. Fall meeting. Royal York Hotel, Toronto. Sept. 30-Oct. 2.

American Society of Tool Engineers. Semi-annual meeting. Lincoln Hotel, Indianapolis, Ind. Oct. 10-12.

American Welding Society. Annual meeting. Hotel Morrison, Chicago, Ill. Oct. 18-21.

National Metal Congress & Exposition. Annual meeting. Palmer House, Chicago, Ill. Oct. 18-22.

Society of Automotive Engineers, Aircraft Engineering & Production meeting. Biltmore Hotel, Los Angeles, Calif. Sept. 30-Oct. 2.

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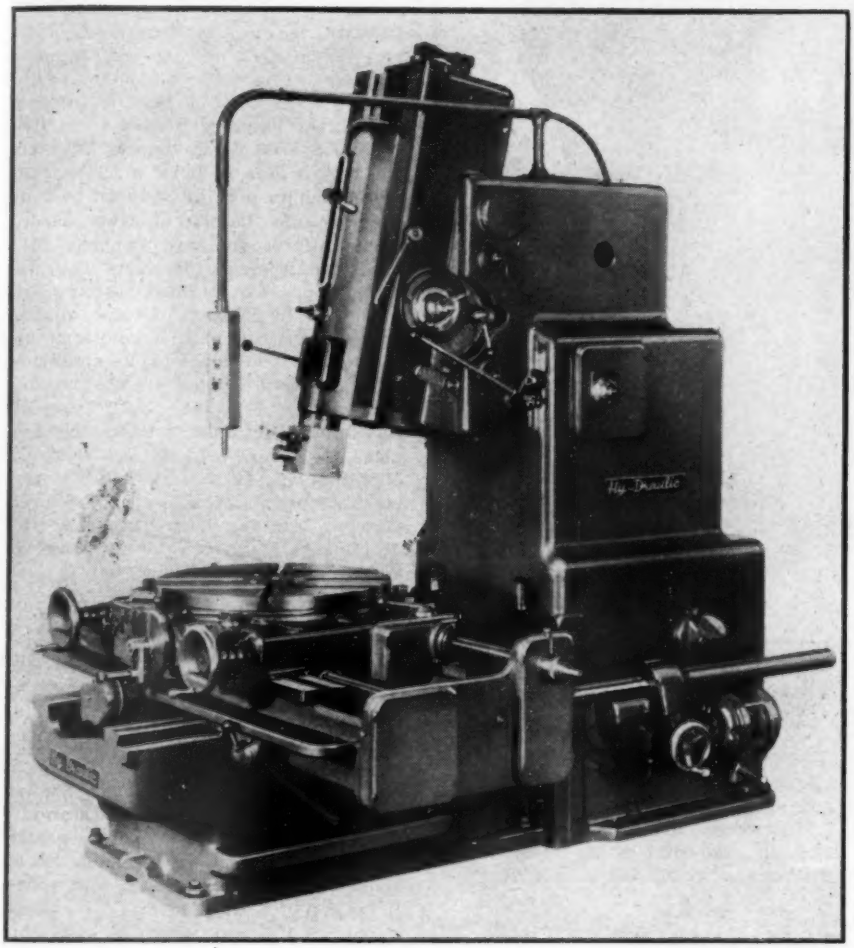
Shop Equipment News



Rockford Produces 12-In. Hy-Draulic Slotter Which Features Hydraulic Ram Drive and Feeds

Rockford Machine Tool Co., 2498 Kishwaukee St., Rockford, Ill., has brought out the 12-in. Hy-Draulic slotter. The machine has a 12 in. maximum stroke and will slot to the center of a 48 in. circle. Minimum space under the ram guide is about 18 in. Cutting speeds are infinitely variable between 10 and 75 ft. per min. Maximum ram return speed is 100 ft. per min.

This slotter has hydraulic ram drive, manual and hydraulic longitudinal and transverse feed, also power rapid traverse. It has manual and hydraulic rotary feeds to the table, and power rapid traverse. Feed to the table is infinitely adjustable between 0 and 0.106 in. per cutting stroke for transverse movement, between 0 and 0.053 in. for longitudinal movement, and between 0 and 0.106 in. on a circle 6 in. in diameter for circular movement.

The circular table, graduated on the periphery, is provided with T-slots in four directions. Micrometer dials graduated in thousands of an inch show exact movements of the table. Final drive to the table is through a worm and worm gear, with suitable adjusting means. The diameter of the table is 28 in. It has longitudinal and transverse travel of 26 in. as well as rotary movement.

This machine occupies a floor space 86×112 in., and has an over-all height of 113 in. The distance from the table top to the floor is 36 in. It weighs 12,500 lb. net.

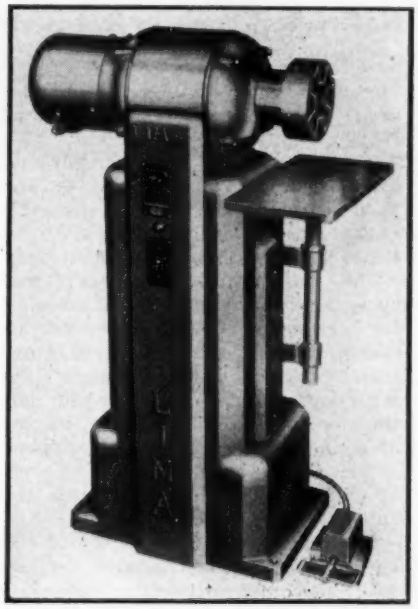
Meyercord Marproof Decals Made in Wide Color Range

After the war, Meyercord Co., Lake & Lorel Sts., Chicago, Ill., will have available for all industries Marproof, wear resistant decalcomania nameplates for permanent application on raw, painted or crinkle-finished metal. At present these decals are being furnished for use in essential industries only.

Marproof decals are usable on flat, convex or concave surfaces. They are being produced in a wide range of colors in either the Type C open letter design or the Type G background transfer design.

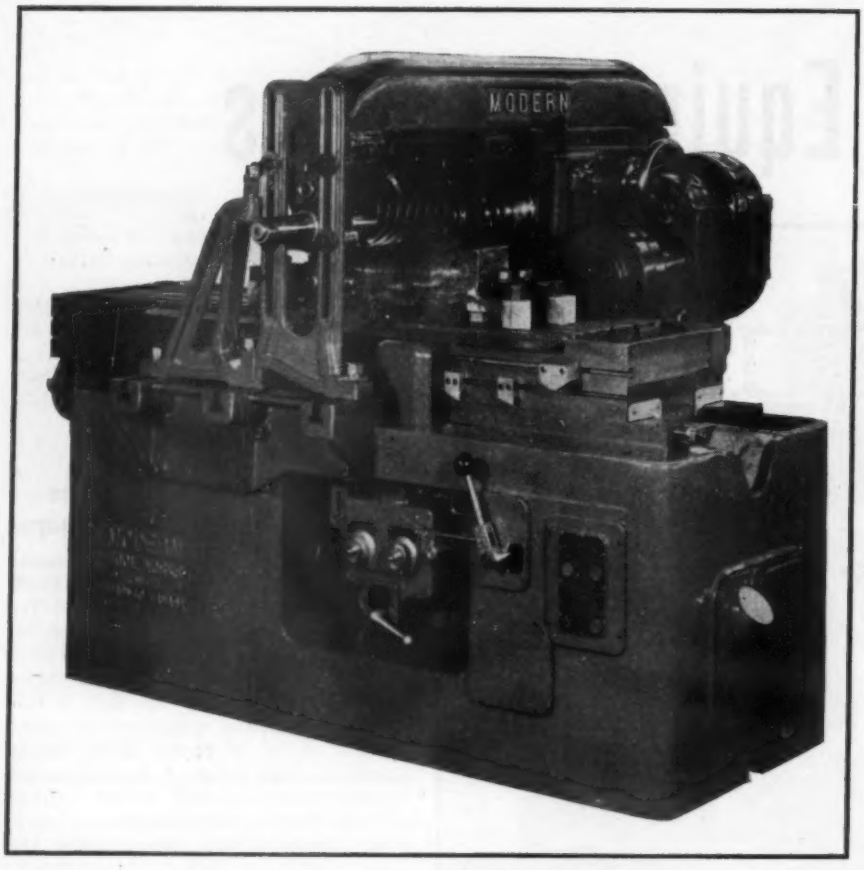
Lima Magnetic Polishing Lathe Holds Ferrous Metal Shapes

The magnetic polishing lathe made by Lima Electric Motor Co., 1501 Findlay Road, Lima, Ohio, is suited for holding steel and other ferrous metal shapes for polishing, burring or lapping operations. It holds parts from 1½ in. diameter up. The unit is furnished with either single or two speed motors, 2 or 3 phase, with motor speeds to 3,600 r.p.m. A self-contained rectifier unit supplies direct current to the chuck. Interchangeable faceplates and register plugs make the



lathe adaptable to various types and sizes of work. This machine can be supplied in pedestal or bench type.

Pedal control can be located in any convenient position. The control magnetizes the chuck, starts the motor, stops the motor and demagnetizes the chuck. It leaves the operator free to use both hands for handling and processing the work. A swinging table is attached to the pedestal. This pedestal can be raised or lowered to accommodate different diameter chucks, and may be adjusted to any position convenient to the operator.



Modern Tool Produces Hydraulpro Milling Machine With Flexible Automatic Feed Cycle Features

The Hydraulpro milling machine has been brought out by Modern Tool Works Limited, 69 Montcalm Ave., Toronto, Canada. This machine is available in two sizes, the 14-36 and 14-60. Designation of the numerals indicate 14 in. work table width by either 36 or 60 in. longitudinal feed.

The automatic intermittent feed cycle features are flexible and designed for high output, continuous manufacturing of such parts as exhaust intake manifolds and cylinder heads. By means of suitable fixtures and continuous cycle, multiple gang milling of such parts as multi-jaw clutches, spline shafts and many other types of parts can be handled on this machine.

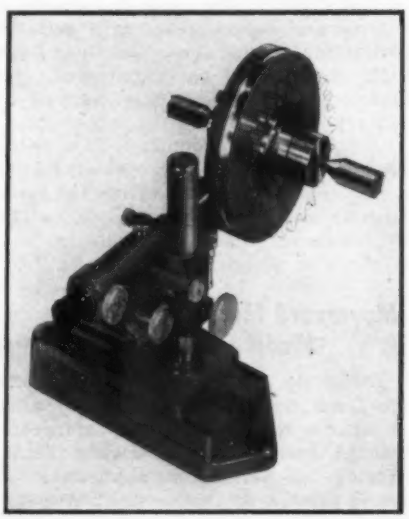
Convenient arrangement of the trip dogs and hydraulic infinite variable feed mechanism provide complete automatic cycles. Such features as the gate type front overarm brace and slip-on type splined pick-off gears located in a hinged-type door at the rear of the spindle housing provide a quick means of changing spindle speeds. The electrical control panel is so arranged that spindle rotation may be interlocked and synchronized with table movements. All controls are within easy reach of the operator in normal operating position.

Three motors used in this machine include a 5 hp. built-in motor which drives the spindle head, a 3 hp. motor in the base, direct connected to the tandem hydraulic pump, and a ¼ hp. motor direct connected to the impeller type coolant pump.

Net weight of the 14-36 machine is 9,300 lb., and that of the 14-60 milling machine is 11,000 lb.

Engis Circular Tester Checks Spacing of Gear Teeth

Engis Equipment Co., 310 South Michigan Ave., Chicago, Ill., is marketing a circular division tester which consists of two units, a master circle and a microscope. This testing instrument is suited for checking spacings in gears, camshafts, splined shafts or index plates. It can be brought to the work and is, therefore, also suitable for checking dividing heads, indexing mechanisms and large pieces.



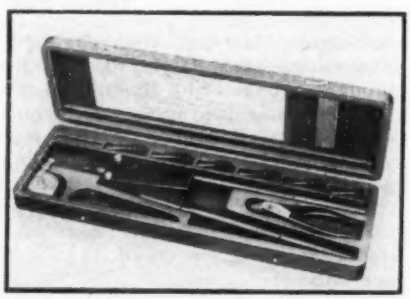
The master circle is attached to the part to be checked and centered in its mount by means of two fine radial adjusting screws in conjunction with a precision dial indicator held against a groove around the periphery of the master circle. This groove is adjacent to a silver band graduated to ⅓ deg. and numbered every degree. The circle mount has a bore of 2 in. diameter, which may be reduced to 1 in., according to the size of arbor used.

The microscope unit consists of a base and upright for supporting the microscope. To facilitate setting and focusing in relation to the master circle, rack and pinion motions are used for the microscope mounting. The principal feature of the reading micrometer is that each complete reading is obtained within the eyepiece. A fixture which clips over the objective end of the microscope provides ample illumination of the circle division. For angular readings, a table of divisions gives angular spacing of parts from 2 to 200.

Cherry Rivet Gun Kit Includes G-10 Hand Gun

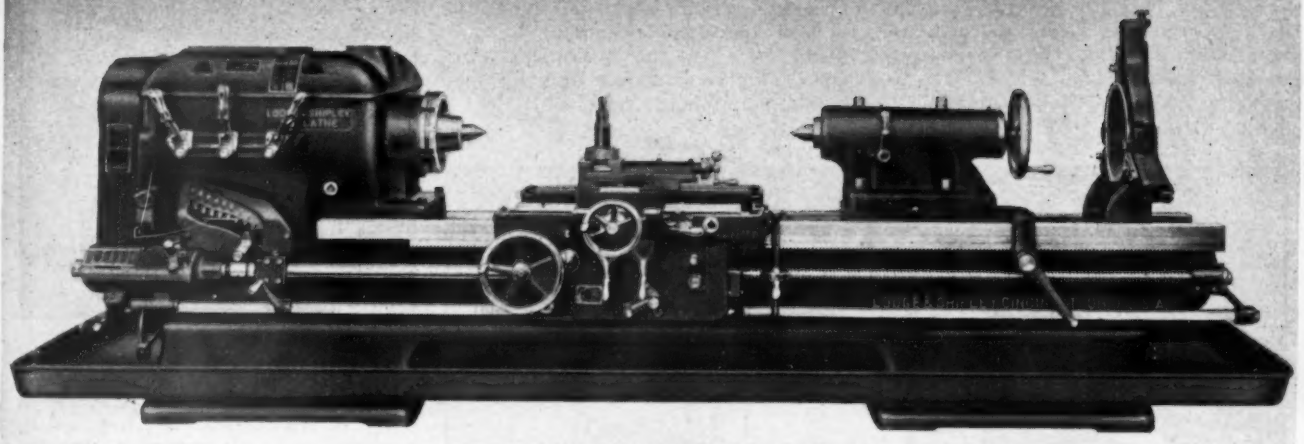
A rivet gun kit brought out by Cherry Rivet Co., 239 Winston St., Los Angeles, Calif., includes the G-10 hand gun, six interchangeable pulling heads and accessories for the gun. Pulling heads fit ⅛, 5/32 and 3/16 in. standard diameter rivets, one each for countersunk and brazier type heads in all sizes being included. The case measures 23½×7¼×2 3/16 in.

The G-10 gun permits servicing operations where air power is not available. Pulling force is generated by means of a ratchet which exerts



an intermittent pull until the stem of the rivet breaks. This gun weighs 2½ lb. The movable handle travels through an arc of 49 deg. Operation of the snubber is by exerting pressure on the end of the pulling head. As soon as pressure is released and the handles brought together, the snubber is no longer effective and the drawbolt returns to its starting position. G6 heads or a G6AA 90 deg. angle adapter only can be used with the tool.

TOMORROW'S LATHE ... TODAY!



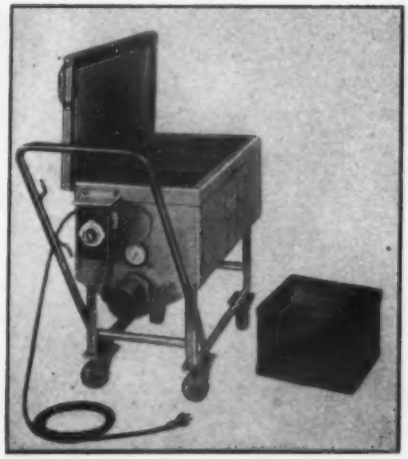
INCORPORATING every feature necessary for easy and profitable operation, the Lodge & Shipley 25" and 27" Selective Head Lathes are powerful, heavy duty machines which reflect in every detail the experience gained over many years of specialized manufacture of lathes. Whether the job be one requiring unusually close limits of accuracy or one where speedy removal of metal is necessary by heavy hogging cuts, these lathes provide an ease of operation which permits the operator to do far more and better work with less expenditure of effort.

Write for detailed information.

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES



Waxmaster Hot Wax Tanks Made for Coating Parts

Illustrated is the Waxmaster, Jr. tank, built by Aeroil Burner Co., West New York, N. J., for hot dipping parts in wax to protect them from moisture and salt air. The unit is electrically heated and operates on 110 or 220 volts a.c. or d.c. It is portable and is mounted on roller bearing casters. The tank and cover are insulated to reduce heat loss. Average liquid capacity of the tank is 12 gal.

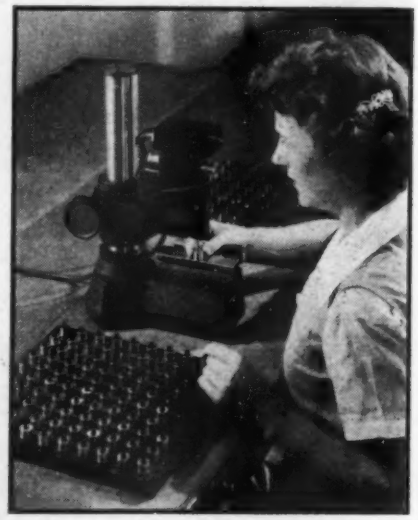
Automatic control of temperatures is provided by a thermostat equipped with dial and knob to shut off the electric heating element and automatically maintain temperatures from 100 to 550 F. The equipment also includes a built-in thermometer with an indicating range of 100 to 600 F. The unit is provided with two wire dipping baskets to hold the parts to be waxed.

The company also has available the Waxmaster Model 1 WGT with a liquid capacity of 30 gal. It is suited for plants using city gas or liquefied petroleum gas. This model can also be heated by kerosene for outdoor use. It works on the double boiler principle. The inner boiler contains the wax while the outer boiler is fitted with an immersion tube heating unit filled with approximately 32 gal. of high flash heat transferring oil. This tank has a built-in thermometer similar to that furnished with the Waxmaster, Jr. Optional accessories are dipping baskets and automatic heat control.

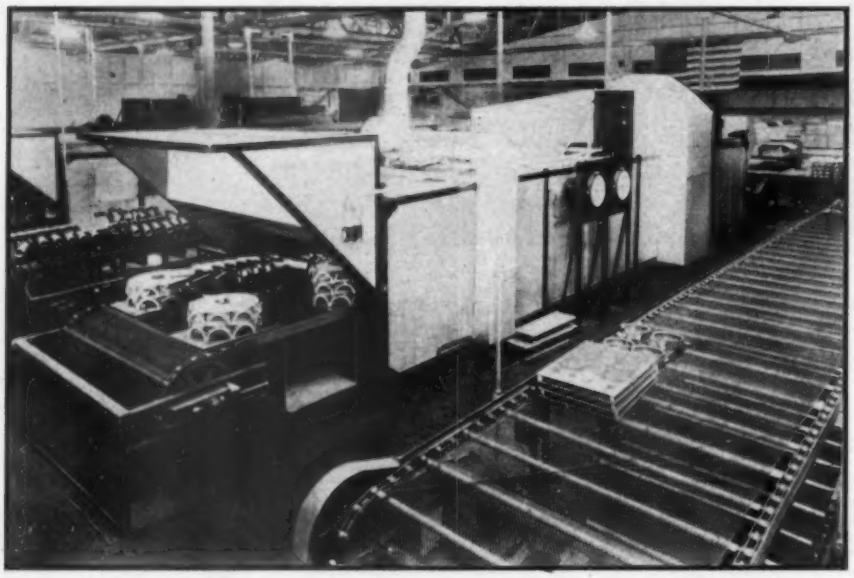
Sheffield Electrichek Gage Checks Tolerances by Lights

The Electrichek made by Sheffield Corp., Dayton, Ohio, provides bench type production inspection for checking close tolerances. It is a limit type comparator, and indicates by signals whether the work part dimension is within tolerance. The gage has a vertical adjustment capacity of 0 to 6¾ in., and column to gaging point throat capacity of 3⅞ in. It has an adjustable range equivalent to 12 snap gages.

A red light shows undersize, a green one oversize, while an amber light indicates that the part is within tolerance. The gage can be set to an accuracy of 0.000010. The Electrichek employs frictionless reed mechanism.



In cases of color-blindness, defective vision or other special conditions, it is possible to use bells and buzzers as signals instead of lights.



Gehnrich Makes Conveyor Type Oven for Baking Paint On Aluminum Parts of Different Sizes and Weights

A conveyor type oven for baking paint on miscellaneous aluminum parts of airplane engines has been developed by Gehnrich Corp., 35-10 Skillman Ave., Long Island City, N. Y. This oven will handle parts of different sizes and weights.

Parts are placed at one end of this continuous conveyor type oven, electrically heated, and are taken off at the other end. The equipment has insulated dual panel steel construction and houses a flat screen belt continuous conveyor 40 ft. long and 5 ft. wide. This belt is supported on cross flights fitted into heavy-duty roller chain-driven oven sprockets.

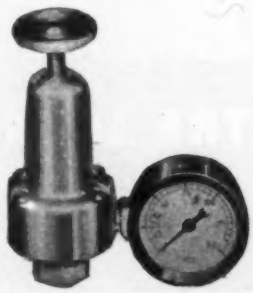
Each oven is provided with a wire mesh belt two-strand roller chain conveyor beside it for returning the baseplates to the loading end of the oven.

Heated air at 150 to 225 F. is supplied into a fuming or exhaust zone in sufficient volume to volatilize the paint solvents. The baking zone is heated by electric elements to 350 F. with uniform air circulation over the heaters through the conveyor and the work by a recirculating fan mounted on the oven roof. The temperature is held within close limits by automatic indicating and recording controllers. Heating protection is provided by safety switches for shutting off the heating load and motor circuit in the event of power or fan failure.

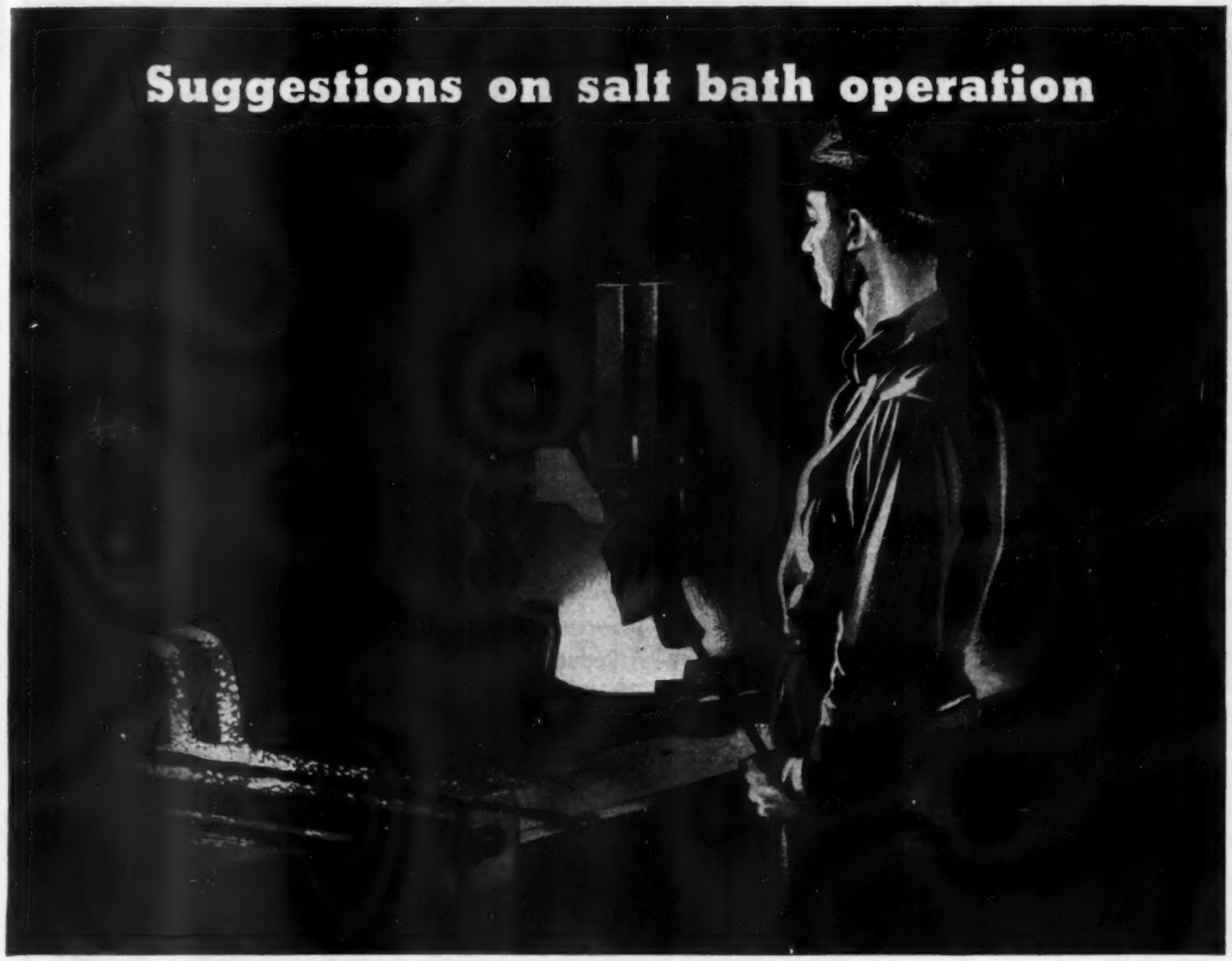
Brown Makes Air Regulator For Tanks and Machinery

The air regulator brought out by W. R. Brown Corp., 5720 Armitage Ave., Chicago 39, Ill., is suited for installation on air tanks, air lines, equipment and machinery for regulating the gripping force of vises by reducing air pressure from the air line or storage tank.

Working pressures from 0 to 140 lb. can be obtained from any air line or storage tank, with initial pressures up to 250 lb. It is said that this regulator is unaffected by oils and water.



Suggestions on salt bath operation



Information supplied by an Industrial Publication

Properly used, the salt bath is a very effective means of preventing decarburization of high speed, carbon, and alloy steels during heat treatment. The following suggestions are offered as an aid to effective high speed tool steel heat treatment.

1. Clean work thoroughly. 2. Immerse in a preheat salt at 1500-1650° F. 3. Transfer to high heat bath at 2150-2250° F. 4. Immerse in quench bath at 1100-1200° F. After cooling to room temperature, wash in a hot alkaline cleaner, then reheat in salt to 1100° F.

To secure maximum pot life, (up to 3 years) use salts that are chemically neutral with refractory pots, and desludge bath periodically. Molten salt seals off all atmosphere, therefore decarburization, carburization, pitting, etching, or other surface defects can be avoided by using a suitable chloride salt and adding an acid rectifier. Several preparations are available containing rectifiers.

Adequate circulation in the bath is necessary to insure uniform temperature and prevent overshooting. Externally heated pots are not practical at high temperatures, so internally heated electrode baths, preferably with automatic, or electromotive, circulation are regarded as the most effective for mass production.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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MOLY

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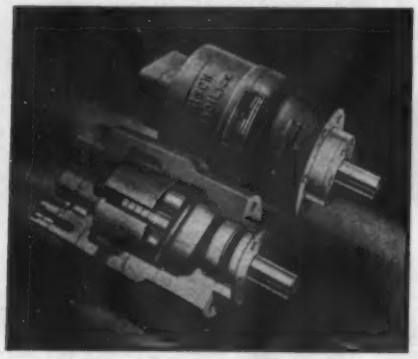
Denison Hydroilic Fluid Motor Has Floating Drive Feature

Denison Engineering Co., Columbus 16, Ohio, is making an Hydroilic fluid motor with a floating drive. This feature provides an axial piston-type fluid motor without mechanical linkages or universal type drive rods. It



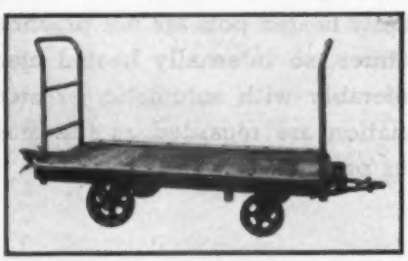
is a positive displacement motor with direct connections and constant contact between driving and driven elements.

The fluid motor is adaptable to horizontal, vertical or angular mountings. Faceplate, footplate and flange type mounting plates are available. This drive has a maximum speed of 1,800 r.p.m. and minimum of 100 r.p.m. Maximum pressure is 1,000 lb. per sq. in. The unit weighs 16 lb. approximately.

Stepless speed variation is provided in this floating drive. Working parts of the motor operate in a constant bath of the oil which is used to power it.

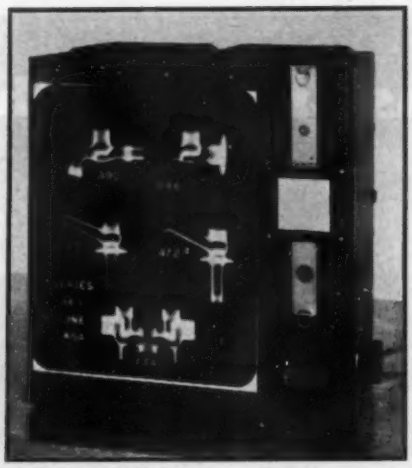
Rose Model 610 Trailer Has an Automatic Hitch

Model 610 all-purpose industrial trailer is manufactured by Rose Manufacturing, Detroit, Mich., and is distributed by H. L. Pitcher Co., Strathmoor at Fullerton, Detroit, Mich. The frame is made of 3×2½×5/16 in. T-iron, reinforced by two 2×2×5/16 in. longitudinal angles. The floor boards are of hardwood. A standard automatic hitch is provided, although the



manually operated type may be furnished as optional equipment.

Racks are interchangeable on the sides or ends. The caster wheels are 10 in. in diameter with a 3 in. face. Rear wheels are 12 in. in diameter with a 3½ in. face. They are equipped with Hyatt bearings and are provided with high pressure lubrication.



Keleket X-Ray Illuminator Permits Intensive Film View

The Keleket high-intensity X-ray industrial illuminator has been brought out by Kelley-Koett Manufacturing Co., 212 West 4 St., Covington, Ky. This illuminator increases intensity of illumination about four times. It measures 14×17 in., so that even the largest film can be viewed without repositioning. Masks are used to reduce the illuminated surface when smaller films are examined. A 3-in. spot with four times the intensity of the large front surface permits intensive examination of critical areas on the film. An air-cooled water cell prevents a rise in front-surface temperature during operation. The increased intensity also makes it possible to use films of greater density with resultant improvement in radiographic contrast.

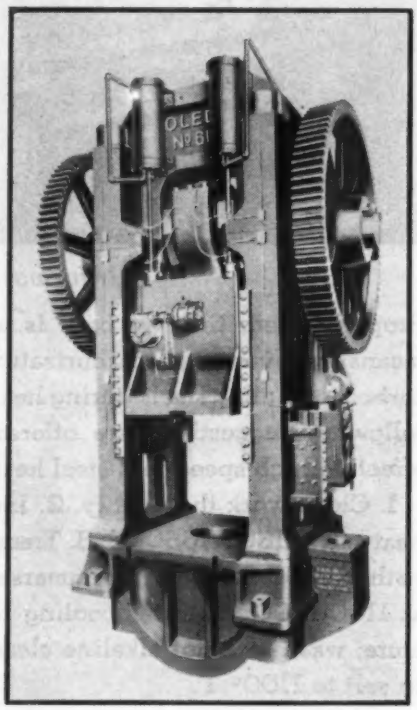
The view box is equipped with a Variac control which affords a stepless increase in intensity by varying the voltage from 0 to 110 volts. A wet film hanger allows films to be observed immediately after they are developed. Films are protected from the heat of the photo-flood lamps by the cold front. A heat absorbing glass baffle and cooling fans which circulate 900 cu. ft. of air per min. dissipate excess heat.

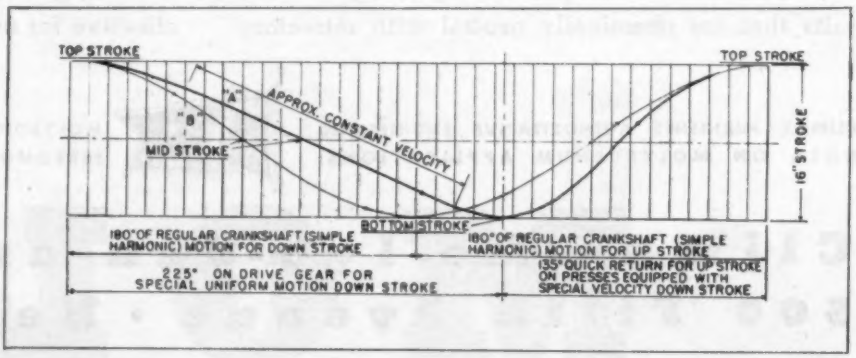
Bliss No. 88—A Reducing Press Has Quick Return Drive Which Increases Speed of Machine on Redraw Operation

The No. 88-A mechanical reducing press made by E. W. Bliss Co., 53 St. & Second Ave., Brooklyn 32, N. Y., features a quick return drive. Speed of the press is materially increased on redraw operation, without any increase in the drawing speed.

The displacement curves illustrated on the accompanying diagram show the difference in motions and velocities of two slides actuated by two different crank motions while operating at the same number of strokes per minute, and over the same length of stroke. The stroke of the slide is 34 in., counterbalanced by air. Slide face area is 18×29½ in. Bed area of the machine is 36×36 in.

Twin driving gears are employed on this press to provide the torsional load between two slides and slabs of the shaft. The machine is of four-piece steel tierod frame construction with double gearing and operates at 14 strokes per min. This press is equipped with a multiple disk, flywheel type, air friction clutch and brake with pushbutton control. For maximum production, a six-station dial feed is employed on the machine.




TOP STROKE
TOP STROKE
"A"
APPROX. CONSTANT VELOCITY
"B"
MID STROKE
16" STROKE
BOTTOM STROKE
180° OF REGULAR CRANKSHAFT (SIMPLE HARMONIC) MOTION FOR DOWN STROKE
180° OF REGULAR CRANKSHAFT (SIMPLE HARMONIC) MOTION FOR UP STROKE
225° ON DRIVE GEAR FOR SPECIAL UNIFORM MOTION DOWN STROKE
135° QUICK RETURN FOR UP STROKE ON PRESSES EQUIPPED WITH SPECIAL VELOCITY DOWN STROKE

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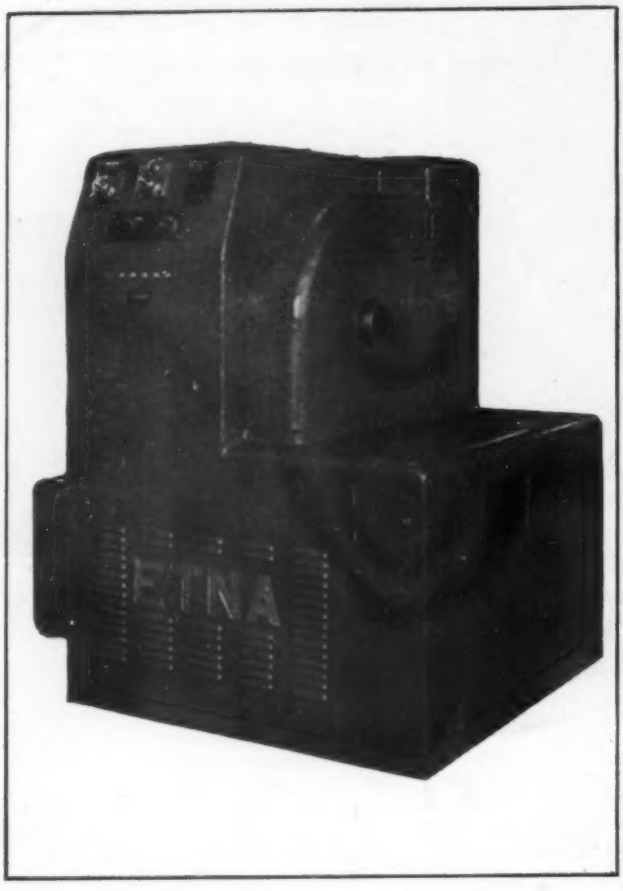

Etna Tube Cutoff Machine Avoids Marring the Work

Etna Machine Co., 3400 Maplewood Ave., Toledo, Ohio, is making a tube cutoff machine in capacities ranging from ⅛ in. outside diameter with ⅛ in. wall, up to 12 in. outside diameter with 1½ in. wall.

The drive motor, hydraulic pump and motor, hydraulic cylinders and equipment are mounted within the same base with the rotating cutter head. The spindle is mounted on Timken tapered roller bearings, and is V-belt driven. An infinite number of speeds can be obtained through the alternating current drive. Spindle speeds are controlled by hand by adjusting a knurled dial.

Tubing to be cut may be fed through either end of the spindle. The rotating spindle is provided with a stationary liner, so that no revolving parts touch the tube being cut off. The tube remains stationary. Hydraulically operated clamping jaws hold the tube while the rotating cutting head crops the ends of the tube, or cuts it in various lengths. Removable liners are provided for the spindle and tube clamping jaws to guide and clamp the tubes over the entire range of the machine. Tubes do not have to be straightened before cutting.

Two parting tools cut off the tube. If desired, roll disk type cutters may be used on thin-wall tubing. An hydraulic cylinder moves the cutting tools in and out. The feeding rate of the tools can be varied to increase or decrease the depth of cut by turning the dial on the hydraulic metering valve.

The toolholders are individually adjustable to suit the particular size and wall of the tube to be cut. The rapid traverse is adjustable by turning the hand dial on the control panel. This rapid traverse feature saves time when cutting thin wall tubing, and allows the tool to amply clear the next tube being pushed through the spindle. A red pushbutton is provided on this panel for emergency stop or return of the tool slides after the cycle has started. The panel also includes four pushbutton stations: Stop and start of the hydraulic pump motor, stop and start of main drive motor. Hand operated dials are provided for quick regulation of the feed of the cutting tools, and for adjustment of the rapid traverse of tools. The machine has a centralized point for greasing internal parts.

After the operator pushes the cycle-start button, the machine automatically clamps the tube, the tools rapid traverse up to the tube automatically, then change to the present feed rate and cut off the tube. Finally, the tools back off and rapidly turn to the original starting position, whereupon the jaws automatically unclamp the tube. The operator then pushes the tube to the next length to be cut and is ready for the next cut on the machine.

Covel Cutter and Tool Grinder Handles Variety of Operations

The No. 12 universal cutter and tool grinder is being built by Covel Manufacturing Co., Benton Harbor, Mich., for handling a large variety of grinding operations. The machine has been designed for convenience of operation. All controls have been placed within easy reach of the operator. The table and saddle are mounted on ball bearings supported by slides. This provides a free working slide.

One end of the spindle is tapered to receive a grinding wheel collet, while the other has a straight ½ in. diameter to receive small-diameter cup wheels. Collets for 1¼-in. hole grinding wheels are furnished to fit either the tapered or straight end. The main spindle of the machine is mounted in a quill for easy renewal or removal for inspection. A ¾ hp. motor drives this spindle. A lock is provided for holding the spindle when changing grinding wheels. The grinding wheel has three speeds.

Bearings are lubricated by a sight wick glass oiler. A lock holds the spindle while changing grinding wheels. Three speeds are available through a V-belt which is readily accessible for quick change. The belt can be adjusted for tension.

A large variety of attachments are available for this grinder which make the machine adaptable to many different kinds of grinding operations.

Getting the most out of your hobs

CORRECT CUTTING SPEEDS

Diam. Inches	FEET PER MINUTE: 15	20	25	30	35	40	45	50	55	60	65	70	80	90	100	110	120	130	140	150
	REVOLUTIONS PER MINUTE																			
¼	229	306	382	458	535	611	688	764	840	917	993	1070	1222	1375	1528	1681	1833	1986	2139	2292
⅜	153	204	255	306	357	407	458	509	560	611	662	713	815	917	1019	1120	1222	1324	1426	1528
½	115	153	191	229	267	306	344	382	420	458	497	535	611	688	764	840	917	993	1070	1146
⅝	92	122	153	183	214	244	275	306	336	367	397	428	489	550	611	672	733	794	856	917
¾	76	102	127	153	178	204	229	255	280	306	331	357	407	458	509	560	611	662	713	764
⅞	65	87	109	131	153	175	196	218	240	262	284	306	349	393	437	480	524	567	611	655
1	57	76	96	115	134	153	172	191	210	229	248	267	306	344	382	420	458	497	535	573
1⅛	51	68	85	102	119	136	153	170	187	204	221	238	272	306	340	373	407	441	475	509
1¼	46	61	76	92	107	122	138	153	168	183	199	214	244	275	306	336	367	397	428	458
1⅜	42	56	70	83	97	111	125	139	153	167	181	194	222	250	278	306	333	361	389	417
1½	38	51	64	76	89	102	115	127	140	153	166	178	204	229	255	280	306	331	357	382
1⅝	35	47	59	71	82	94	106	118	129	141	153	165	188	212	235	259	282	306	329	353
1¾	33	44	55	66	76	87	98	109	120	131	142	153	175	196	218	240	262	284	306	327
1⅞	31	40	51	61	71	82	92	102	112	122	132	143	163	183	204	224	244	265	285	306
2	29	38	48	57	67	76	86	96	105	115	124	134	153	172	191	210	229	248	267	287
2¼	25	34	42	51	59	69	76	85	93	102	110	119	136	153	170	187	204	221	238	255
2½	23	31	38	46	54	63	69	76	84	92	99	107	122	138	153	168	183	199	214	229
2¾	21	28	35	42	49	57	64	70	76	83	90	97	111	125	139	153	167	181	194	208
3	19	25	32	38	45	51	56	64	70	76	83	89	102	115	127	140	153	166	178	191
3½	16	22	27	33	38	44	49	55	60	66	71	76	87	98	109	120	131	142	153	164
4	14	19	24	29	33	38	43	48	53	57	62	67	76	86	96	105	115	124	134	143
4½	13	17	21	26	30	34	38	42	47	51	55	59	68	76	85	93	102	110	119	127
5	12	15	19	23	27	31	34	38	42	46	50	54	61	69	76	84	92	99	107	115
5½	10	14	17	21	24	28	31	34	38	42	45	49	56	63	70	76	83	90	97	104
6	9	13	16	19	22	26	28	31	35	38	41	45	51	57	64	70	76	83	89	96
7	8	11	14	17	19	22	25	29	32	35	36	38	44	49	55	60	66	71	76	82
8	7	10	13	15	17	19	22	25	27	30	31	33	38	43	48	53	57	62	67	72
9	6	9	11	14	16	17	19	22	24	26	28	29	34	38	42	47	51	55	59	64
10	5	8	10	12	14	15	17	19	21	23	25	26	30	34	38	42	46	50	54	57
11	5	7	9	11	13	14	16	17	19	21	23	23	27	31	34	38	42	45	49	52
12	4	6	8	10	12	13	15	16	17	19	21	21	24	28	31	35	38	41	45	48

1. Use the above table to determine the correct cutting speed for different hob sizes.
2. Remember a sharp hob cuts faster than a dull one.
3. Use Michigan hobs for longest life.
4. Get a copy of "Hobbing" from Michigan Tool Company (Bulletin No. 149).

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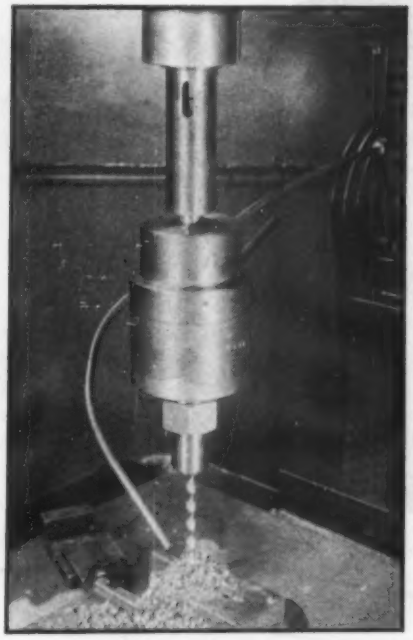
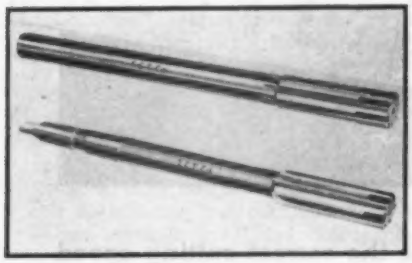


Rego Karweit Driller Fits Standard Drill Press

The Rego Karweit driller, made by Bastian-Blessing Co., 4203 Peterson Ave., Chicago 30, Ill., is interchangeable with the conventional chuck and may be operated at handbook cutting speeds and feed rates with ordinary drills. The device comes in two sizes. No. 1 is suited for drills up to ¼ in., and No. 2 is for drills ¼ to 9/16 in.

In operation, the driller lifts the drill a small amount each revolution repeatedly to terminate the chips being formed and to lubricate both sides of the cutting edges. The reciprocating action which follows with this movement produces chips at the cutting edge which are substantially uniform in size and shape. Chips are kept loose enough to clear the flutes easily without packing. Furthermore, the action accelerates penetration of the lubricant to the cutting edges.

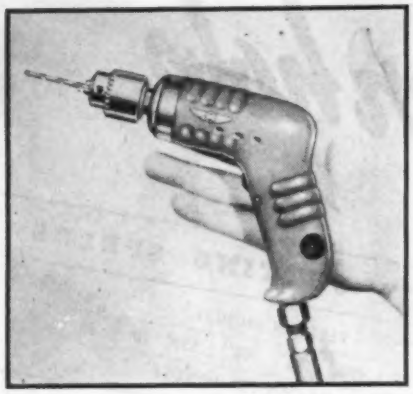


Tungsten Carbide Reamer Made With Hardened Shank

Standard sizes of carbide tipped reamers with hardened shanks are available from Tungsten Carbide Tool Co., 2361 Joy Road, Detroit 6, Mich. The line comprises both straight shank and tapered shank varieties, with sizes ranging from ¼ to 1½ in. in both styles. Up to 1 in., the reamers come in steps of 1/32 in., while on those over 1 in., the diameters change by 1/16 in. Reamers up to ½ in. are provided with four flutes, with six flutes for reamers from ½ in. to 13/16 in. inclusive, and eight flutes for larger sizes.

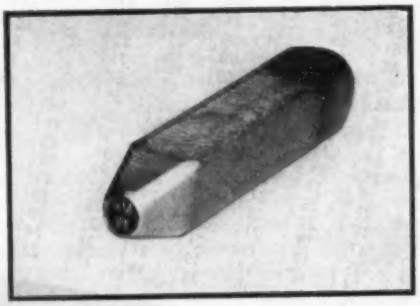
The entire shank of this reamer is hardened to provide greater strength and reduced shank wear. All tips are diamond ground, while the outside diameter is held to tolerances of + 0 and — 0.0003 in.

Aro Makes Pneumatic Drill With All-Plastic Housing



A pneumatic drill with a plastic case is being produced by Aro Equipment Corp., Bryan, Ohio. The unit weighs 1 lb., 12 oz. It operates at 2,500 r.p.m. and measures 6¼ in. over-all length. This drill accommodates ⅛, 3/16, ¼ or 5/16 in. drills with Jacobs chuck.

The tool has full ball-bearing construction, and a built-in visible oiler. Ribbing incorporated in the plastic handle provides a non-slip grip.



New Method Inspection Stamp Identifies Magnafluxed Part

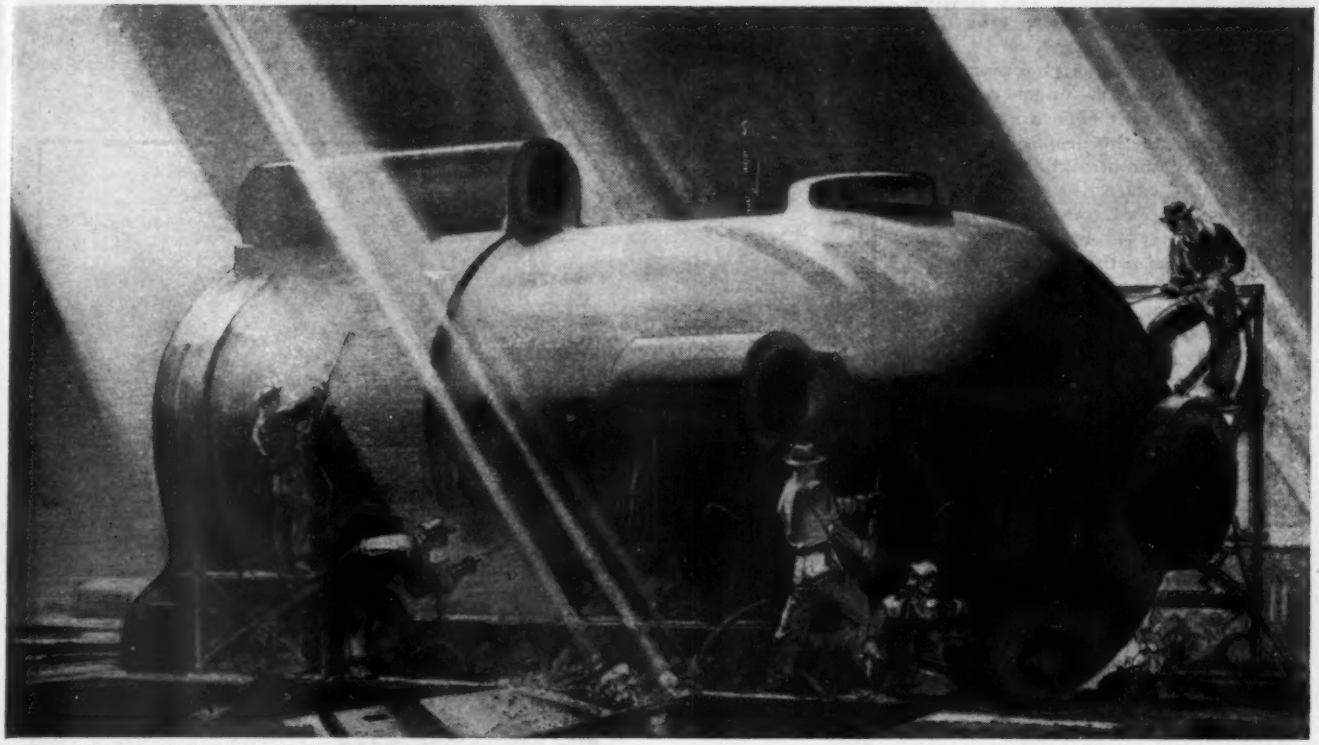
New Method Steel Stamps, Inc., 147 Jos Campau St., Detroit 7, Mich., is producing a line of inspectors' stamps for Magnaflux work. The letters MF have been incorporated in the stamp together with a border that can be supplied in a variety of shapes, such as circular, oval, square or triangular. This stamp provides means of identification of the operator who passed the part through the inspection, as well as indication that the part has been Magnafluxed. Each operator will have his particular stamp registered.

Detroit Universal Hook Checker For Thread Milling Cutters

For the checking of hook or rake angles and flute spacing in sharpening thread milling cutters, Detroit Tap & Tool Co., 8432 Butler Ave., Detroit 11, Mich., is offering a universal hook checker. It handles both shell and shank type thread milling cutters from ½ up to 6½ in. outside diameter and up to 12 in. in length. All cutting faces up to 7 in. of flute length can be inspected at all points for accuracy and uniformity of grinding.

The offset distance can be read directly from an integral micrometer barrel by visual aligning of a ground straight edge with the face of the cutter flute against an illuminated background. Placement of an indicator finger against the cutting face enables any error of flute spacing to be read directly on an integral indicator dial.

The measuring assembly, in which the straight-edge finger and the indicator are mounted, is provided with a vertical adjustment controlled by a handwheel. Two micrometer barrels which control the movement of the straight edge for right- and left-hand offsets respectively are calibrated to measure the offset distance from a radial line. A diffusing glass background illuminated by a lamp in the base is located directly beneath the straight edge. The spacing indicator and its finger are positioned to meas-



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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

STRONG STEEL—THE METAL BY WHICH OTHER METALS FLY AND FIGHT

Gouged, hammered, pried from its mold of sand and gagger-bars, this mammoth one-piece casting of war-steel emerges in a form of massive strength to do a job on the production front as no other material could do it. A product of the art and skill of J&L foundrymen, this casting, a hydraulic cylinder, is the heart of power for a gigantic extrusion press. Strong steel in this and other castings, weighing up to 280,000 pounds, enables the giant mechanical presses to exert pressures so great as to squeeze aluminum, copper, brass and other metals, as well as certain steels, through small die openings like a pastry cook extrudes cake-icing through the tip of a pastry cone.

By this extruding process these other metals are formed into hundreds of parts for aircraft engines, flying instruments and airplane assemblies as well as parts for weapons and other fighting equipment.

Thus steel — strong steel — which is being produced at the rate of 90 million tons a year, is doing two war jobs. First: steel is serving on the invasion fronts in the form of tanks, guns, ships, planes, ammunition and other military supplies, and second: it is serving on the production front in the form of machines, large and powerful, small and intricate, that shape other metals and materials including plastics and certain steels into equipment and arms for victory.

PITTSBURGH WORKS

ALIQUIPPA WORKS

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

CONTROLLED QUALITY STEEL FOR WAR

J&L STEEL

ure any error of cutting face spacing by comparison with the spacing of a master index plate.

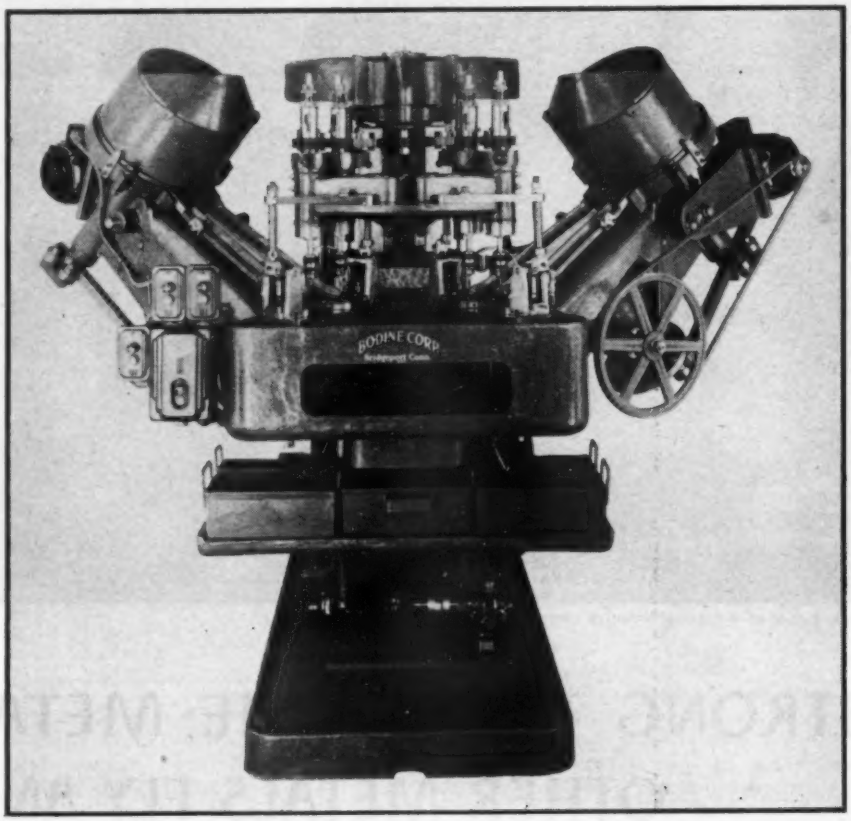
To check a right-hand hook or offset of a cutter face, the upper center is used. The straight edge finger is slid into the flute to the proper depth and locked. With the straight edge of the finger on the centerline of the cutter, the right-hand micrometer is backed off. The cutter is rotated until the fine light between the cutting edge and cutter face disappears. To check a left-hand offset, the finger is turned over and left-hand micrometer used.

The indexing center is used to check flute spacing. The bellcrank indicator finger is inserted into a cutter flute and the cutter rotated until the finger engages both the face and the indicator plunger. With the indicator set at zero, indexing the cutter to the next flute will indicate any error in spacing.

Gar-Bro Fitting for Wire Rope Combines Shackle and Thimble

The Gar-Bro Shimble wire rope fitting made by Garlinghouse Bros., 2416 East 26 St., Los Angeles 21, Calif., is a combination shackle and thimble. This fitting is made with open and closed ends. It is adaptable to many uses wherever shackles or sprockets are used, such as guy anchorages, tractor hitches, crane slings, equalizers. The Shimble is available in all rope sizes from ⅜ to 1⅝ in.

The unit is fabricated from steel plate and shaped to the correct rope radius. It may also be welded to other attachments, or the side plates may be bent to fit special conditions.



Bodine Nut Tapping Machine Feeds Four Nuts at a Time

Bodine Corp., 317 Mountain Grove St., Bridgeport, Conn., has developed a high-speed automatic nut tapping machine in two sizes. One machine handles nuts up to and including ¼ in.-28, and the other handles ½ in.-20. The tapper delivers four nuts simultaneously to four tapping stations by means of two hopper feeding mechanisms, each equipped with two adjustable chutes. These machines require 80×55 in. and 80×80 in. floor space, respectively.

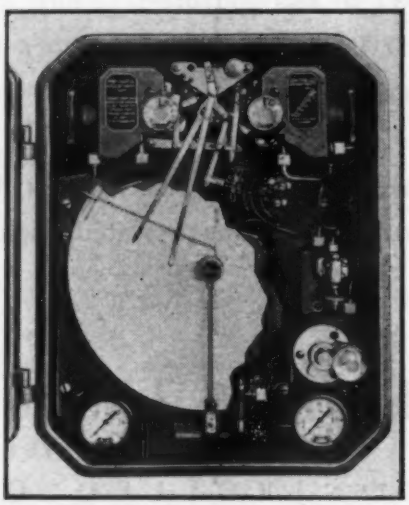
If desired, two sizes of nuts can be run simultaneously. Each spindle carries its own compensator which allows the tap to follow its own lead. When components can be fed by hopper, a battery of machines can be handled by one operator.

Both machines may be factory adapted to include countersinking and tapping; or drilling, counterboring and tapping, by addition of a suitable automatic indexing dial.

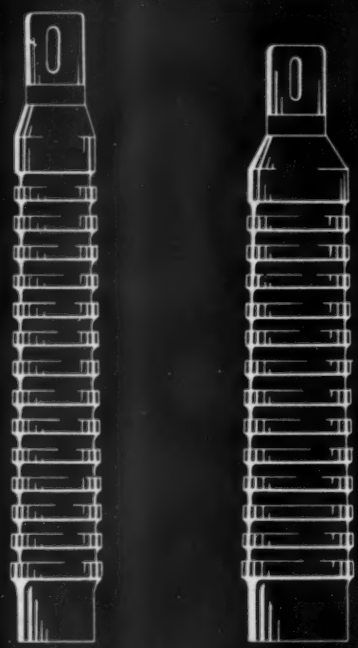
Taylor Pneumatic Controller Developed in Two Forms

A pneumatic set controller has been developed by Taylor Instrument Companies, Rochester 1, N. Y. This instrument features a control point, as indicated by a set pointer, that is automatically adjusted by variation in output air pressure from another remotely located instrument. The controller has been made in both the indicating and recording forms.

The instrument is fundamentally a Fulscope controller with an additional unit to convert changes in input air pressure into linear movements of the set pointer. The magnitude of linear set pointer movement per pound change in input air pressure is governed by the setting of the adjustment dial provided in this unit. The



BOTH these Broaches are the right length



	HOLE DIAM.	
1"		1½"
.030"	STOCK REMOVED	.040"
2"	EFFECT. LENGTH OF HOLE	2½"
0.375	CU. IN. PER STROKE	0.628

for the specific job each performs

How to get more out of your Broaches------

BY USING CORRECT BROACH LENGTH

There is a correct broach length for best performance on any job, depending on type of material to be broached, amount of stock removed, etc.

If the broach is shorter than this, it usually means a bigger step per tooth and you may have to sharpen more frequently, you may have increased tooth breakage, or finish may be inadequate.

If the broach is too long you lose productive time without gaining anything.

The job of correctly calculating the proper length of a broach for any given job is not difficult but it does require the availability of empirical data on actual broach performance on similar applications, similar materials, etc.

We will be glad to put at your disposal the experience we have gained in calculating and observing thousands of broach installations and recommend the correct broach length for best overall results in any given setup.

colonial BROACH COMPANY

25th Anniversary

DETROIT 13, U.S.A.

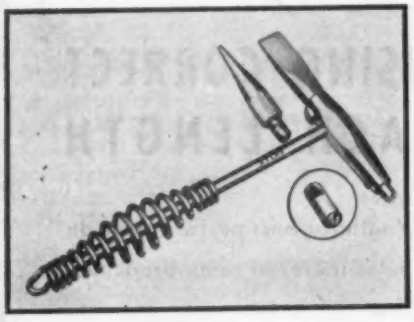
Broaches — Broaching Machines - Broaching Equipment

controller provides also for set pointer adjustments in either direction for an increase in input air pressure. In addition, this unit provides for limiting the traverse of the set pointer within given limits. A manual set pointer adjustment is included with the instrument.

Atlas Weld Marking Hammer Can Be Used for Chipping

The symbol hammer made by Atlas Welding Accessories Co., 307 Boulevard Bldg., Detroit 2, Mich., is a combination weld marking tool and chipping hammer. This tool is 10½ in. long and weighs 16 oz. A choice of interchangeable and replaceable alloy steel cone or chisel bits is available. Symbol and bit shanks are positioned and held by setscrews in a socket-fit.

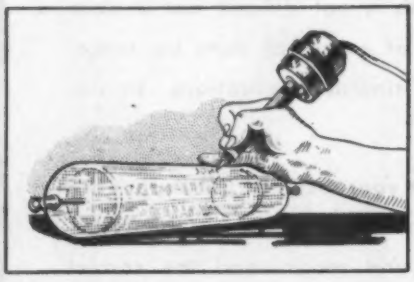
Identification marks can be furnished in 600 standard alphabetical and numerical combinations. Standard sizes of the symbol range from 3/32 to ½ in. inclusive, with larger or smaller sizes available.



Breuer Electric Writing Tool Marks Plastics and Metal

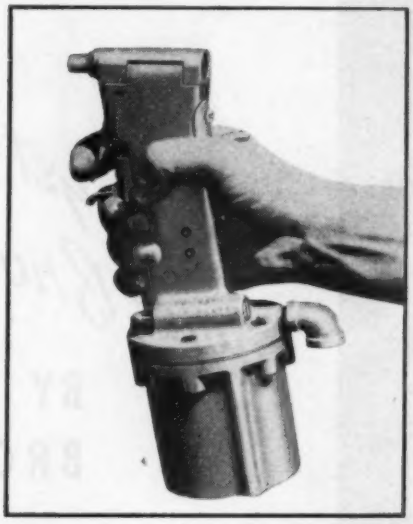
An electric writing tool for permanent marking of materials such as brass, glass, plastics, wood, hard rubber, aluminum, steel and bronze is offered by Breuer Electric Mfg. Co., 5100 North Ravenswood Ave., Chicago, Ill. The tool operates like a pencil and provides more than 7,000 cutting strokes per min. The cutting stroke is adjustable for shallow or deep cutting. It operates like a pencil and writes as fast as the fingers can move. The Tornado tool plugs into an electric light socket.

This device is made in different models for light or deep etching, and is designed for operation on 115 to 130 volts, 50 to 60 cycles a.c.



Cherry Pneumatic Rivet Gun For Driving Blind Rivets

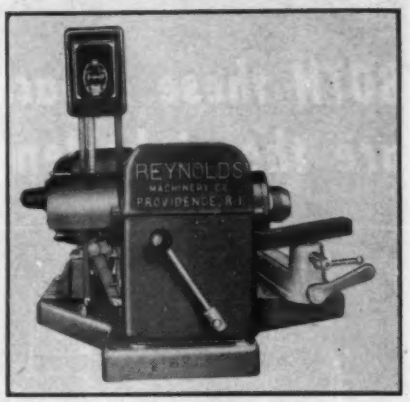
Cherry Rivet Co., 239 Winston St., Los Angeles, Calif., is making an all-pneumatic G15 gun of cast aluminum, steel and bronze for high-speed application of blind rivets. This gun is suited for double surfaced structures where access to one side of the work is obstructed. The over-all height of the tool is 10 5/8 in., with maximum diameter of 3⅞ in. It weighs approximately 4½ lb. and operates on 75 to 100 lb. per sq. in. pressure.



Three interchangeable pulling heads handle the three standard diameters of Cherry rivets, ⅛, 5/32 and 3/16 in., either hollow or self-plugging types. Clearance around the rivet axis is ⅜ in. Hose connections are standard for ¼ in. lines. The tool will operate equally well for any position.

Pope Balancing Kit Holds Grinding Wheels

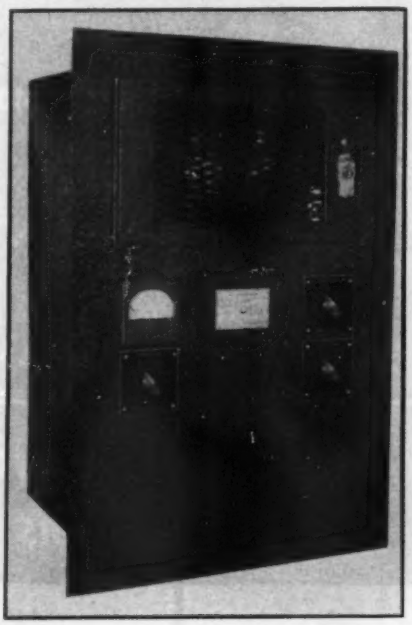
A grinding wheel balancing kit has been produced by Pope Machinery Corp., Haverhill, Mass. The kit is suited for wheels up to 8 in. diameter, ¾ in. wide and 1¼ in. hole, such as used on 6×18 in. surface grinders and other similar equipment.



Any Standard Motor Used On Reynolds Polishing Lathe

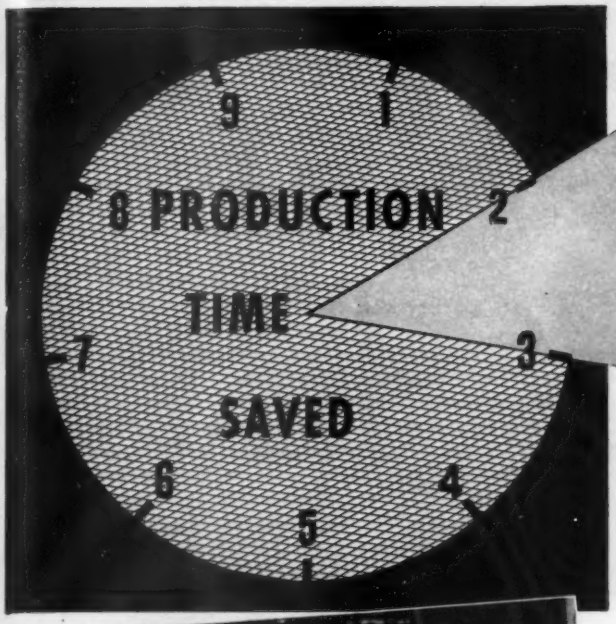
Reynolds Machinery Co., Providence, R. I. announces production of a new collet head lathe unit for polishing, finishing, filing and burring operations. Features of the device are: any standard motor can be used; single lever control for starting, stopping, applying the brake and opening and closing the collet, and the spindle may be stopped to inspect the work without disturbing the setting of the piece.

The machine uses a No 5c Rivett collet; the spindle nose is threaded to provide for a 4 in. chuck which may be had as an extra. With the four-step V-belt drive supplied, the speed ranges are as follows: with 1725 r.p.m. motor—1725-900-750-600 r.p.m. with 1200 r.p.m. motor — 1200-750-600-450 r.p.m with 3450 r.p.m. motor—3450-1800-1500 and 1200 r.p.m.



Furnace Operation Improved By Furnatron Controller

Because resistance-furnace temperatures are likely to vary, Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., has devised the Furnatron control system to keep such variations to a minimum. This objective is accomplished through combining a suitable



Production Increased 800%

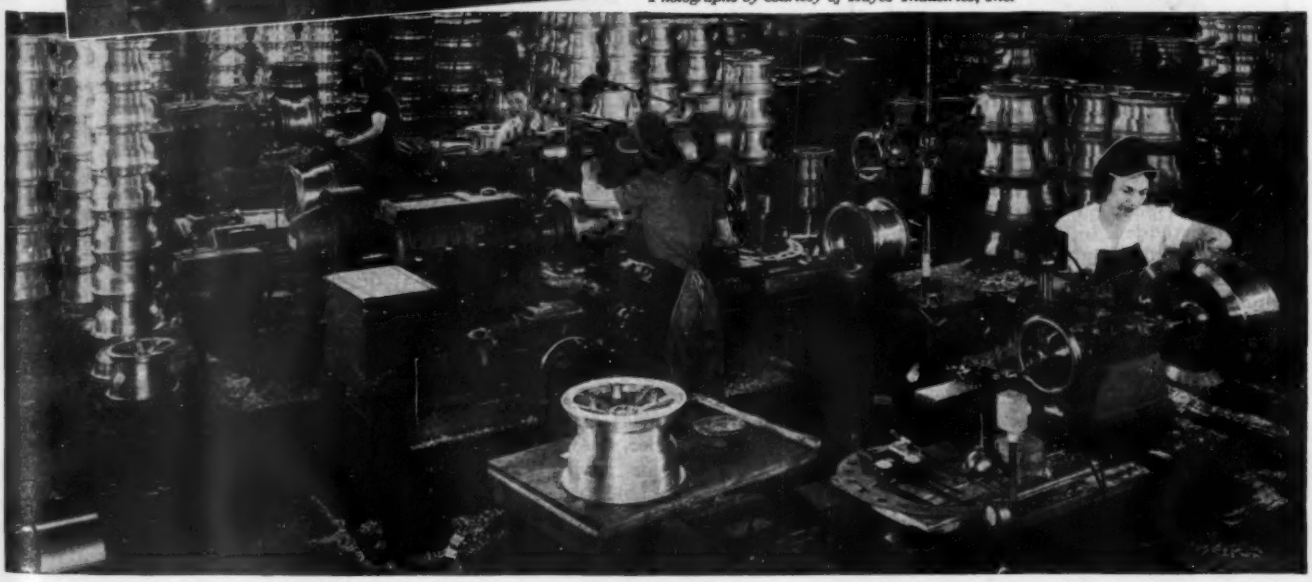
The height of the stack of eight wheels, in the lower picture, compared to the height of the one wheel, shows the *relative* increase in the number of these wheels finished per day, now and formerly. The operation consists of turning the outside diameter, from rim to rim. Formerly, this was done on standard lathes. By putting the job on Monarch-Keller lathes, with electric controls, production was increased 800%. By this method, a thin metal template is drawn over an electrically controlled tracer, and the cutting tool *automatically* follows the specified contour, thus permitting greatly increased speed and accuracy of production.

Monarch-Keller lathes are similarly increasing production of many and varied kinds of war work. If we can help you select the right tool for the right job, we'll gladly work with you.

THE MONARCH MACHINE TOOL CO. · · · SIDNEY · OHIO

MONARCH LATHES *Save Time*

Photographs by courtesy of Hayes Industries, Inc.

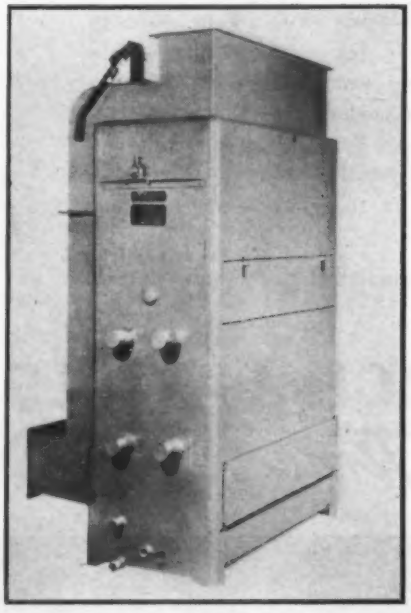


thermocouple type of temperature controller with an automatic electronic control, thereby automatically controlling the power input into the furnace.

The Furnatron system may be used with a single or three-phase furnace. Where the line or furnace transformer voltage is not suitable to supply alternating current to the thyratron tubes, an anode transformer is supplied. A droop corrector, another optional feature, is included for installations where the rate of the material flowing through the furnace changes, thus compensating for heat exchange due to fluctuations in the rate at which the furnace is being loaded. The Furnitron also includes a compensator for line voltage variations, which also effect operation of a resistance furnace. The complete regulator is arranged for flush panel mounting.

Niagara Aero Heat Exchanger Includes Heat Adding Unit

Niagara Blower Co., 6 East 45 St., New York 17, N. Y., has modified its Aero heat exchanger to add heat to industrial liquids that must be maintained at constant temperatures. This exchanger is now suited to control



temperatures of quenching baths in the heat-treating of metals and of cutting oils and lubricants in metalworking, machining and wire drawing.

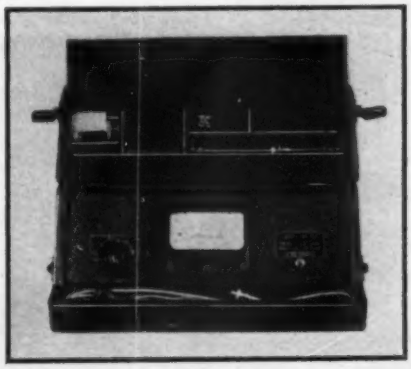
Heat is added to the temperature-controlled liquid by means of a steam coil, injector, or electric heating unit connected into the spray water system. If cooling of the liquid is called for by the thermostatic control, the heating element is cut out, and the evaporator type liquid cooling system acts alone, using a water spray and fans drawing air over the coils. Thus alternate heating or cooling is made possible to keep liquid temperatures within prescribed limits for the particular process involved.

Johnson Rotary Joint for Connecting Coolant to Spindle

By means of a special rotary pressure joint, manufactured by the Johnson Corp., Three Rivers, Mich., coolant can be admitted to the inside of the spindle of turret lathes and conducted directly to the point of machining. The joint is a packless type of stuffing box and consists of two carbon graphite rings. Pressure within the joint is the sealing force. The design of the joint compensates for misalignment of piping, both angular and lateral.

Physicists' Profilometer Measures Surface Roughness

A portable Type Q profilometer has been made available by Physicists Research Co., 354 South Main St., Ann Arbor, Mich. This instrument is designed for use on 115 or 230 volts, 50 to 60 cycle. It measures surface roughness by direct dial readings.



This unit is small, light and portable. The case has storage compartment for the various accessories, which include the Type M tracer, flexarm, glass specimen, and Type I or J tracer. Power and tracer cables are stored in a compartment in front of the panel.

The meter panel, which is set at a 45 deg. angle, permits readings while the operator is seated. The profilometer tracer is adjusted to the same calibration number, thus requiring no amplifier adjustment in the field.

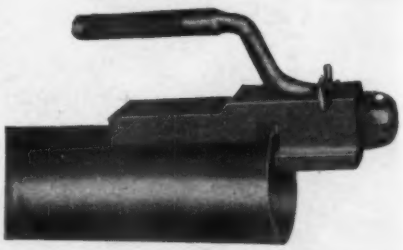
Amercoat No. 33 Plastic Used For Metal and Wood

Liquid plastic known as Amercoat No. 33 for application on metal, concrete or wood has been made available by American Pipe & Construction Co., P.O. Box 3428, Terminal Annex, Los Angeles, Calif. This product can be applied cold by spray or brush methods for lining tanks and protecting machinery. This thermoplastic coating may be applied in any number of coats required to meet particular conditions. Amercoat is a combination of inert synthetic resins.

Cunningham Shell Marker Holds Any Size Characters

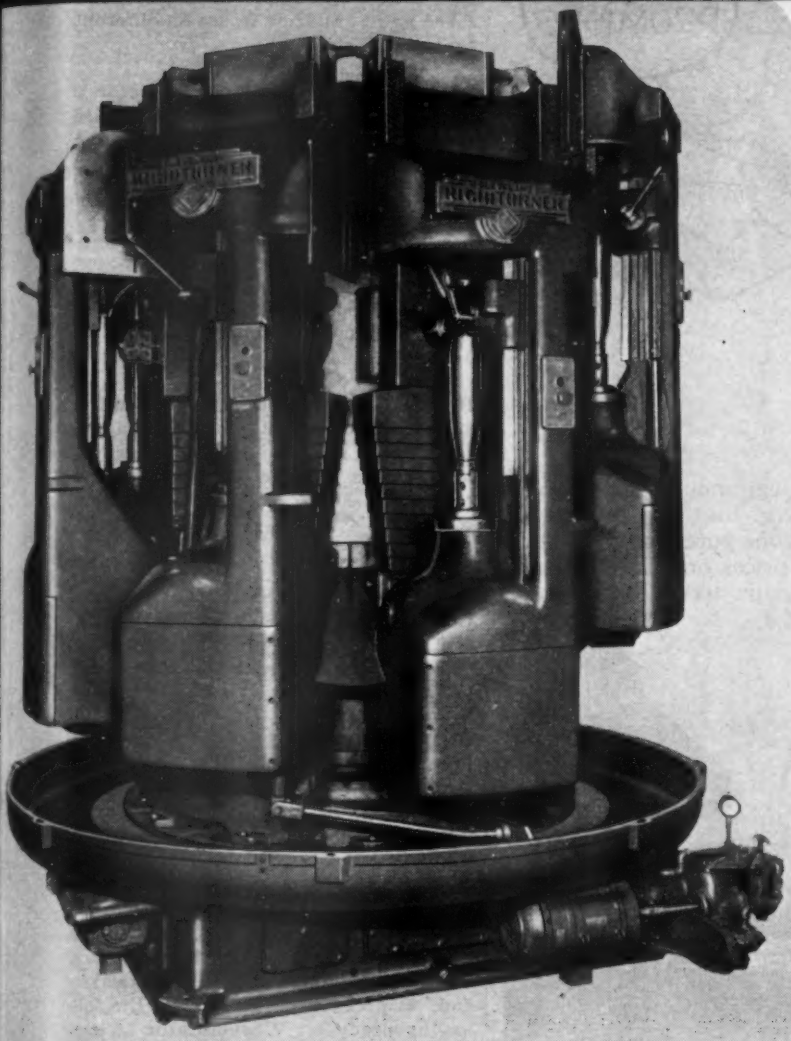
Ends of hot, rough turned shell can be marked with the box-type shell marking holder made by M. E. Cunningham Co., 115 East Carson St., Pittsburgh 19, Pa. The marker can be made for any size or number of characters.

This type holder is one-piece construction to resist spalling and mushrooming, and is held in place by a shepherd hook pin which is removable for changing type inserts.



DEVELOPED
FOR THE MASS PRODUCTION OF MULTIPLE DIAMETER TURNING

THE RIGIDTURNER



THIS BULLETIN tells all about the Rigidturner —what it will do—how it works —and how it can cut your costs for turning multiple diameter work. Write for yours today.

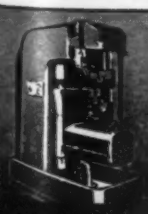
● The Rotary Model Rigidturner has been developed for the mass production of work requiring multiple diameter turning.

The eight spindles operating simultaneously insure maximum production—the use of special form cutters provide faithful duplication and continued accuracy.

The automatic operation of the machine leaves the operator the simple job of loading and unloading the work at loading position.

Today the Rotary Model Rigidturner is making production records in a host of shops producing shell up to 105 MM. Tomorrow—this same machine will provide profitable operation for work to be sold in competitive markets.

Consult a C. H. Engineer on your duplicate turning work.



The CLEVELAND HOBBING MACHINE Company
Cleveland Ohio

Turner can now deliver rush orders on their plug, snap, flush pin and built up gauges. To facilitate deliveries we advise that you send blueprints and complete detailed information with your purchase order. For descriptive literature and prices on Turner's complete line of gauges write us today. (On your company stationery, please.)

TURNER BROTHERS

TURNER GAUGE GRINDING COMPANY
2628 HILTON ROAD • • • • FERNDALE, MICH.

Turner Gauge Grinding Co.
2625 Hilton Road, Ferndale, Michigan

Gentlemen:
Please send me complete information about your gauge deliveries.

Name..... Title.....
Company.....
Address..... State.....
City.....

TRADE PUBLICATIONS

ABRASIVE PRODUCTS Many time and production short cuts in deburring, finishing and polishing are described and illustrated in the Brightboy catalog published by Weldon Roberts Rubber Co., Newark 7, N. J.

AGITATOR A booklet issued by Eclipse Air Brush Co., 390 Park Ave., Newark, N. J., shows Pneumix air-motored paint agitators in use on different types of work.

BEARINGS Why's and wherefore's of designs and uses of each type are included in the 32-page booklet entitled "Facts about Anti-Friction Bearings" issued by Ahlberg Bearing Co., 3050 W. 47 St., Chicago 32, Ill.

BROACHES Features of various types of Red Ring broaches are described in an illustrated brochure put out by National Broach & Machine Co., 5600 St. Jean, Detroit, Mich.

BRUSH STANDARDS Publication No. 43-85 is a second edition of standards for carbon, graphite and metal graphite brushes, and is obtainable from National Electrical Manufacturers Assn., 155 E. 44 St., New York, N. Y., for 25 cents a copy.

CHIP WRINGERS R. E. Lovekin Corp., 200 N. 15 St., Philadelphia 2, Pa., has available a circular describing this equipment. Size specifications are included.

CHUCKING FIXTURE A booklet brought out by Zagar Tool, Inc., Cleveland, Ohio, gives details and includes instructions for setting up and operating its collet chucking and indexing fixture for use on milling machines.

CLEANING A 20-page revised edition reference catalog No. 40, profusely illustrated, has been issued by American Foundry Equipment Co., Mishawaka, Ind. It presents a summary of the following products: Wheelabrator airless blast cleaning equipment—Tumblasts, Tablasts and special cabinets; metal washing machines, Dustube cloth bag type dust collectors; cyclone dust collectors, wet disposal unit for dry type dust collectors; sandcutters; sandblast equipment; rod straighteners and American-Heanium Long-Lyfe blast nozzle.

CONVEYORS A recently issued bulletin of Lamson Corp., Syracuse 1, N. Y., "Six Years' Output in One Year with Lamson Conveyors," illustrates typical applications of the company's products.

DUST COLLECTORS "Dust Collecting in Industry" is the title of a folder issued by Peters-Dalton, Inc., 628 E.

Forest Ave., Detroit 1, Mich. It describes and pictures "Hydro-Whirl" orifice-type dust collectors and their application to magnesium processing.

ENGRAVER Prices of its engraving machine and accessories are included in a 16-page booklet presented by Micro Instrument Co., 80 Trowbridge St., Cambridge, Mass. Description and tables on range of work handled are also included.

FILING Continental Machines, Inc., Minneapolis, Minn., manufacturer, and Doall Co., Des Plaines, Ill., distributor, of Continental band filer and Doall file bands has brought out a well-illustrated circular on this equipment, with specifications.

FLUORESCENT UNIT Model MF-240-N is the subject of a catalog issued by Fostoria Pressed Steel Corp., Fostoria, Ohio.

GRINDER Bulletin E-93, published by Landis Machine Co., Waynesboro, Pa., describes the No. 6 precision thread grinder in detail.

GRINDERS Savage Tool Co., Savage, Minn., has presented a booklet which illustrates and gives specifications of the Doall hydraulic surface grinders.

MILLING CUTTER A 24-page loose-leaf catalog No. 5 made available by Machinists Tool Co., 2830 W. Lake St., Chicago, Ill., contains many illustrations and descriptive material on its line of cutters, counterbores, end mills, reamers, metal slitting saws and toolbits.

OIL. A brochure on Gulf Super-, Quench, produced by Gulf Oil Corp., Gulf Bldg., is just off the press.

PLASTIC E. I. du Pont de Nemours & Co., Plastics Dept., Wilmington, Del., has published a 34-page handbook on "Plastacele" cellulose acetate plastic sheets.

PUMP A comprehensive booklet containing diagrams, blueprints and photographs on Westco pumps is being distributed by Joshua Hendy Iron Works, Pomona Pump Co. Div., St. Louis, Mo. It is designated as catalog No. 43.

SURFACE PLATE Sizes and weights of the Barco surface plate are given in the pamphlet issued by Barco Scraping Co., 1975 E. 65 St., Cleveland, Ohio. One page is devoted to styles and sizes of its line of angle irons and straight edges.

TUBING Loose-leaf sheets on aircraft tubing data are available from Summerill Tubing Co., Bridgeport, Pa.

WHEELS AND POINTS Grinding Wheel Manufacturers Assn., 27 Elm St., Worcester 8, Mass., has issued a

THE *Ally* OF PRODUCTION

The demand for greater production of vital war materials has increased the need for highly efficient equipment for handling those materials. The conveyer system, which is the result of thorough engineering and careful planning, is indeed an ally of greater production. Mathews Engineers at the Factory and in the field are on the job long hours these days, giving manufacturers of war materials the help they require in keeping the production performance climbing.

MATHEWS CONVEYERS FOR MECHANIZED PRODUCTION

If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

MATHEWS CONVEYER COMPANY ELLWOOD CITY PENNSYLVANIA

PROPELLER
JOB TEST
SHOWS CAPEWELL
CUTTING FASTER
AND GIVING 50%
MORE BLADE LIFE
This new Capewell customer had experienced difficulty sawing billets of special steel for propeller parts. Numerous power blades were tested. Capewell's Technite cut the 4½" square, special chrome tungsten alloy billets in 7 to 9 minutes against 13 minutes for the next best competitor. That blade wore out after cutting 12 to 15 pieces, but Capewell's Technite cut 20 to 25 pieces. Tests were run on four identical saws with blades rotated among the different machines.
As a result this manufacturer has not only speeded production, but at the same time has reduced the expense for blades.
Similar savings might be discovered on your operations. Better ask your mill supply man about Capewell.
TECHNITE
The Capewell Mfg. Co.
Hartford, Conn.
CAPEWELL
The Trend is to TECHNITE
The Molybdenum High Speed
Hack Saw Blade

booklet entitled "Mounted Wheels and Points" which gives the principles of safe and efficient operation and tables of critical speeds.

BOOK REVIEW

INDUSTRIAL SAFETY—*Edited by Roland P. Blake. 435 pages. Published by Prentice-Hall, Inc., 70 Fifth Ave., New York.* $5.

The expenditure of manpower on the battlefront is part of warfare; but in industrial plants behind the lines it is almost wholly needless. Each year more than 100,000 Americans are killed by accidents and some 9,000,000 more are injured.

Industry contributes a large part toward this tremendous total of death and injury. In 1941 some 19,200 workers lost their lives through injuries received on the job, while approximately 100,000 others suffered various permanent disabilities. Some 2,000,000 were injured to an extent that caused the loss of at least one day's work.

Safety engineering has proved itself to be effective in combating this appalling industrial loss. This statement is attested by the fact that large companies with well organized safety departments have better records and reflect greater improvements than small firms.

The volume edited by Mr. Blake is compiled from the writings of men with long experience in industrial safety. Three of them are connected with large private business organizations; four of them hold government positions in services where accident prevention is an important part of their work; and the eighth man is an insurance company official.

Together their contributions form a well rounded presentation of the accident problem. The common causes of accidents are analyzed together with time-tested methods of prevention. These include the training of employees, use of protective equipment, the guarding of machines, the building of safety organizations and the use of inspection to remove causes of accidents. The volume also tells how to run a well functioning safety department.

SEEN and HEARD

By JOHN R. GODFREY

Light Engine Treads

Aluminum cylinders are being experimented with again and by several builders of engines. It began, as I recall, during the last war. Lightness was the chief aim and E. W. Roberts of Cincinnati built some engines largely of aluminum. Franklin used forged aluminum connecting rods. They also had the Aluminum Company iron plate some cylinder bores, cam shafts and other parts to get a better bearing surface. I believe Harold Wills, then of the Ford Motor Company, had some patents on the process.

Now one firm is building airplane engines with a very thin cast iron sleeve in an aluminum cylinder. This sleeve is less than a sixteenth thick. Experiments are also being made with chromium-plated alumium pistons running in aluminum bores. These are said to be working out very well in test runs. With weight such an important factor in aircraft this may point the way to better performance witn the same sized engines. It is also possible that automobile designers may turn toward lighter cars, particularly if the same or better performance can be obtained.

Saving 450 Percent!

A little elementary arithmetic would prevent publicity men from making their products absolutely ridiculous. A bit of fourth or fifth grade arithmetic about percentages would tell anyone that when you save 100 percent—"that's all, there isn't any more." So when we see claims of 450 percent saving, or anything over 100 percent we know it's screwy, we just say "baloney" and pass it by without stopping to read the figures.

If instead of dabbling in percentages they would just say, "saves 4/5 of the old time"—it would be O.K. If they must dabble in percentages they might learn that 4/5 means 80 percent—and that you can't save 100 percent without abolishing the operation. Claiming even 100 percent makes a laughing stock of the announcement.

Use of Surplus Tools

By FRED H. COLVIN

Some of the suggestions made by Leo Malchin on the post-war disposition of surplus tools are good, especially the idea of disposing of used machine tools to reestablish small shops put out of business by the war. But these I fear would take a very small percentage of the machine tools that will be available.

While it might be possible to dispose of used machines "as is" to shops in this country, it would mean the careful examination of each machine before purchase as few would buy without knowing the exact condition of the machine before buying. To sell these machines abroad would be disastrous to our foreign relations.

China can well use a large number of used machines in good condition. But when I was there before the war they would buy only new machines because they had been stung so badly on machines that were supposed to be in good condition. Recent conversations with Chinese officials confirms

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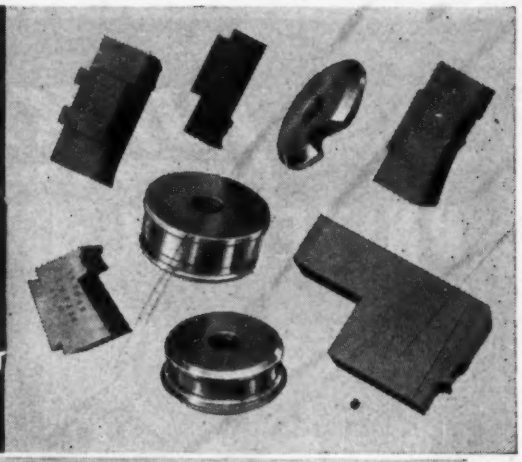

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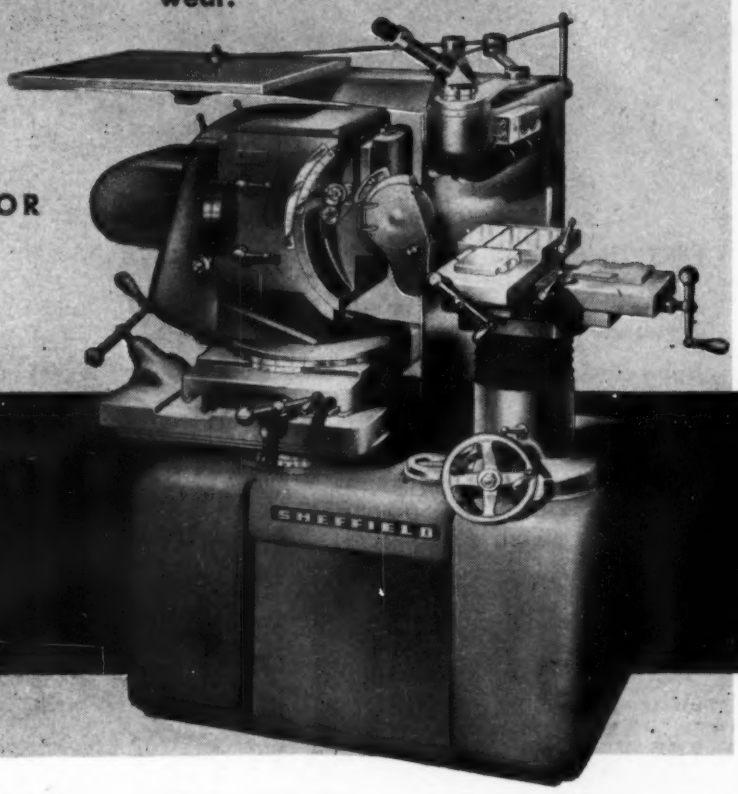

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this antagonism to used machines, based on their previous experience.

These same feelings exist in other countries, and it would be a great mistake to jeopardize friendly relations by dumping machines in uncertain condition in foreign countries.

Surplus machine tools which cannot be put in good condition at an economical cost should be scrapped. All other machines should be reconditioned by thoroughly reputable concerns, preferably by the makers of the machines who are naturally interested in their performance and reputation. This will provide "fill in" work during the readjustment period.

But no matter who does the rebuilding no machine should be sold until its condition has been checked and approved by competent men. It should bear the stamp of approval of either the National Machine Tool Builders Association or of a government agency handling the surplus machinery.

There are already standard tests for many machine tools. These could be modified if necessary for used machines but not enough to affect the **quality** of the work they can do. Greater output can usually be secured from newer machines because of changes in design. But we should not forget that all new machines are built on used machines, some of them not of the latest designs.

What Steel Did You Use?

By A. S. EVES
Chief Field Engineer
Perfection Tool & Metal Heat Treating Co.

Last night at home I was reading a squib in a business magazine which mentioned the government's campaign to conserve man-hours and scarce metals. Out of the day's work I picked a few samples which seem to mean something to every one of us who owes his living to steel.

A chap walked in here with a die, made from four pieces welded together. He asked us to harden it. We looked it over. Evidently he had spent a lot of time on it, and it was worth roughly two or three hundred dollars. On asking him what kind of steel he used, he said he did not know; he had picked it up second hand. So we sparked it, and found one piece evidently was cold-rolled steel, low carbon; another was some kind of oil-hardened steel; the remaining two pieces were high-speed steel.

Naturally that gave us a laugh. But then I thought of the effort being made toward conservation, and wondered just how much of that sort of thing was going on.

A little later, a reputable tool and die shop phoned us raising Ned because three tools they had given us were not alike in hardness. We explained that they had all been marked as a certain kind of tool steel, had been hardened accordingly, but came

out differently. Spark-testing showed them not to be the same. "Well," said the customer, "they all were cut from the same bar." How many, many times we've heard that! But we persisted, and our customer said he would check again and call us back. Two hours later he phoned to say that his shop had not cut the pieces off the bar at all—they had been supplied to him by a customer in another city.

Much the same thing had happened a few weeks before. But in that case, the customer discovered that one of his night gang had made a mistake; so he hid the tool under the bench and cut off a piece of mild steel and made another lest he get fired.

An hour ago, the superintendent came in here and asked me to write a letter to a screw-machine outfit. We are holding some 40,000 vital war parts that have been hardened for the kind of steel specified in the order, but tests show that they represent not one but at least three varieties of steel.

Our chief inspector tells me that hundreds of jobs come in with no information at all as to the kind of steel to be treated—while others are identified as one kind but prove after hardening to be something else.

It is bad enough if they turn out soft. We can anneal and reharden, anneal and reharden, and keep on till we hit something like what is wanted. But we never can turn out tools or parts that way and expect them to give maximum service.

On the other hand, if excessive temperatures are used, the tools or parts are ruined.

Mr. Hulting, our president, tells me that we have to contend with such conditions as these in 10 to 15 percent of our orders. Now our plant handles a lot of jobs—hundreds every day. But still the amount we do is infinitesimal when compared to all the tools and parts treated every day.

I asked him what percentage of tools he thought e v e r actually achieved maximum production and life. What do you suppose he said? *Not over 25 percent!*

Now I've read a lot of splendid articles in your publication on the selection of steels, and proper use of tools, but not a word on the need for closer cooperation between the man who makes the tools and the chap whose duty it is to harden them so they will produce and last to the utmost.

It looks to me as though here is a leak in man-hours that perhaps exceeds the greatest strike in history; and that there is a loss of millions of dollars in scarce materials which can to a great extent be avoided. Some firms seldom err; others are constant offenders. Some seem to be able to keep track of their steels from storeroom rack to hardening room; others don't know what they have half the time and seem to care less. I wonder if there is not an opportunity in this to double the contribution now being made by machinists to the saving of labor and materials?

CHASING RAINBOWS?

Industrial progress has always started with ideas, with visions that may seem to be unreachable. Chasing rainbows is a perfectly proper function of industrial planning—*if* it is tempered with common sense and judgment.

We shall inherit from war production a wealth of new materials and techniques, which will make possible the building of better, more efficient and less costly manufactured products.

Many of today's models will become obsolete. However, their ultimate successors, as envisioned by practical "rainbow chasers", will not arrive overnight. They must first be tested and proved and improved—a process that requires time.

Industry will have an almost infinite choice of materials and methods for postwar products. But remember that word "choice". Selection is not automatic; alternatives must be studied, and decisions based on sound, provable engineering facts, always tempered by cost and ultimate selling price.

In working for many manufacturers, building an infinite variety of products, Trundle engineers have acquired an exceptional background of experience in the use of new materials and techniques. This fund of practical knowledge is available to you in your planning for the future. Would you like to discuss it with us?

Geo. D. Trundle Jr.
President

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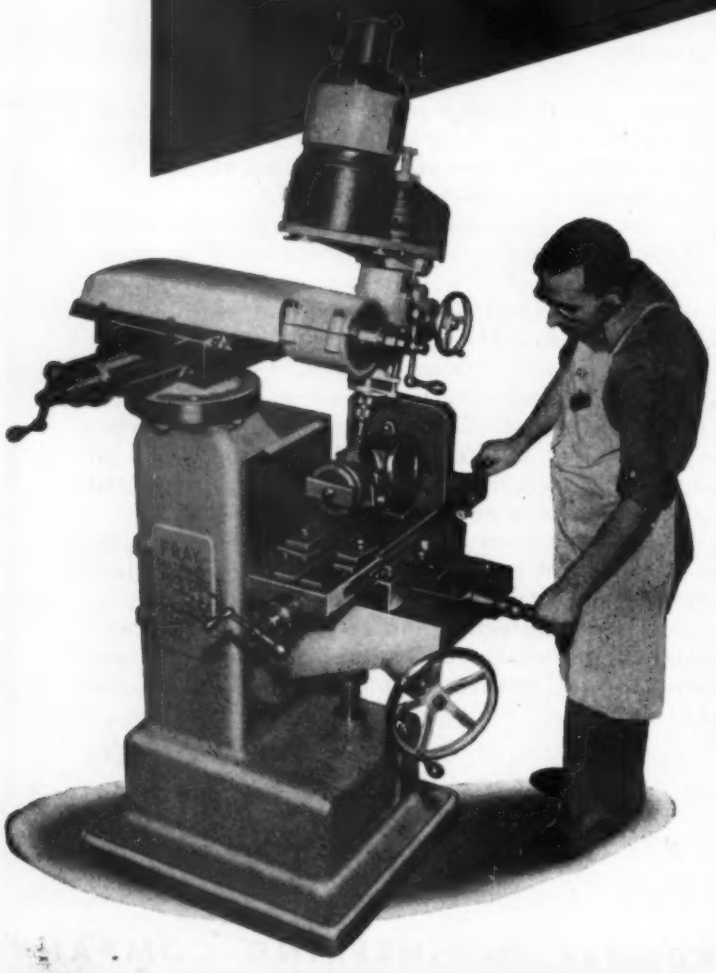

The 10" cross movement of the ram above the work, as well as the 12" transverse movement of the ram, combined with the 360 deg. rotation of the turret head—give a range of operations with one work set-up that is *not possible* with any other milling machine.

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Machining

Monel
"R" Monel
Inconel
"K" Monel
"KR" Monel
Nickel

Techniques for machining the different Monels are described in Bulletin T-12.

As suggested by the Table of Contents at the left, this booklet answers many questions on tool grinding, rakes, clearances, speeds, etc. which you must know to establish your particular technique for machining Monel. Also, this bulletin will help you decide which Monel to use under given conditions, and when "R" and "KR" —special Monels with superior machining properties—should be used.

Stock for Machining
Mechanical Properties
Tool Design
Tool Steel
Cutting Compounds
Cutting-Off Operations
Turning and Boring
Layouts of Tool Design
Drilling
Reaming
Tapping
Lathe Threading
Thread Chasing
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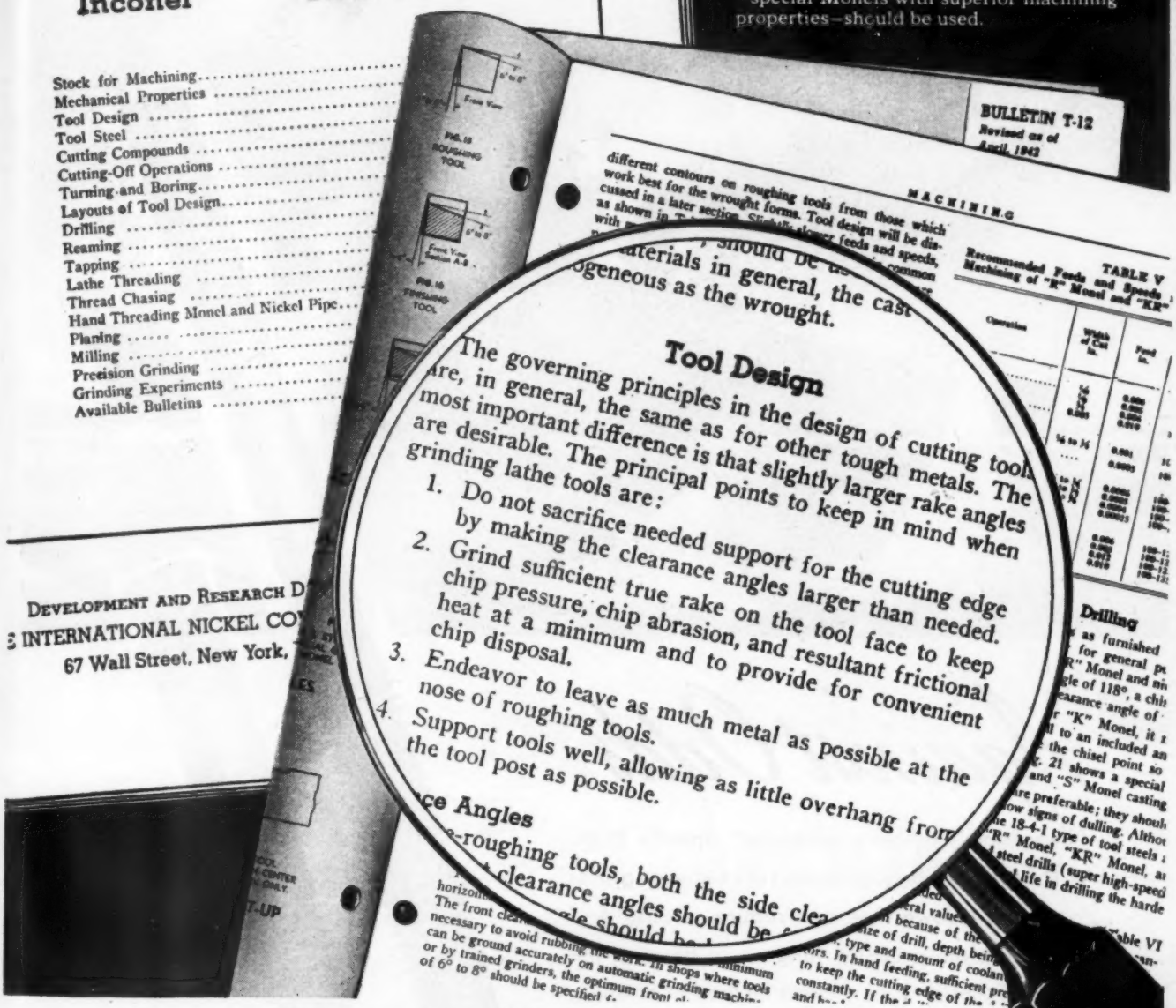
BULLETIN T-12
Revised as of
April, 1943
MACHINING
TABLE V
Recommended Feeds and Speeds
Machining of "R" Monel and "KR"
Drilling
Tool Design
The governing principles in the design of cutting tools are, in general, the same as for other tough metals. The most important difference is that slightly larger rake angles are desirable. The principal points to keep in mind when grinding lathe tools are:
1. Do not sacrifice needed support for the cutting edge by making the clearance angles larger than needed.
2. Grind sufficient true rake on the tool face to keep chip pressure, chip abrasion, and resultant frictional heat at a minimum and to provide for convenient chip disposal.
3. Endeavor to leave as much metal as possible at the nose of roughing tools.
4. Support tools well, allowing as little overhang from the tool post as possible.
Angles
clearance angles should be

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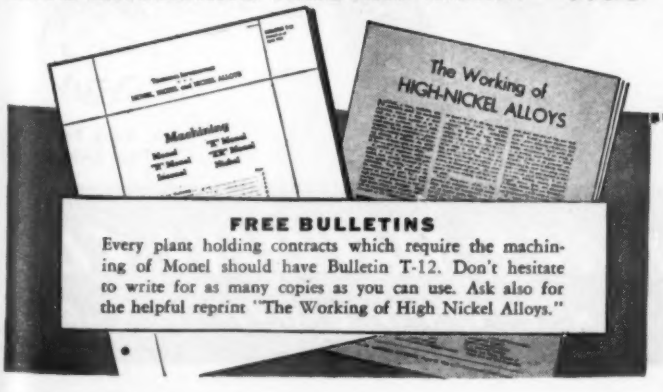

FREE BULLETINS

Every plant holding contracts which require the machining of Monel should have Bulletin T-12. Don't hesitate to write for as many copies as you can use. Ask also for the helpful reprint "The Working of High Nickel Alloys."

The International Nickel Company, Inc.
67 Wall Street, New York, N. Y.

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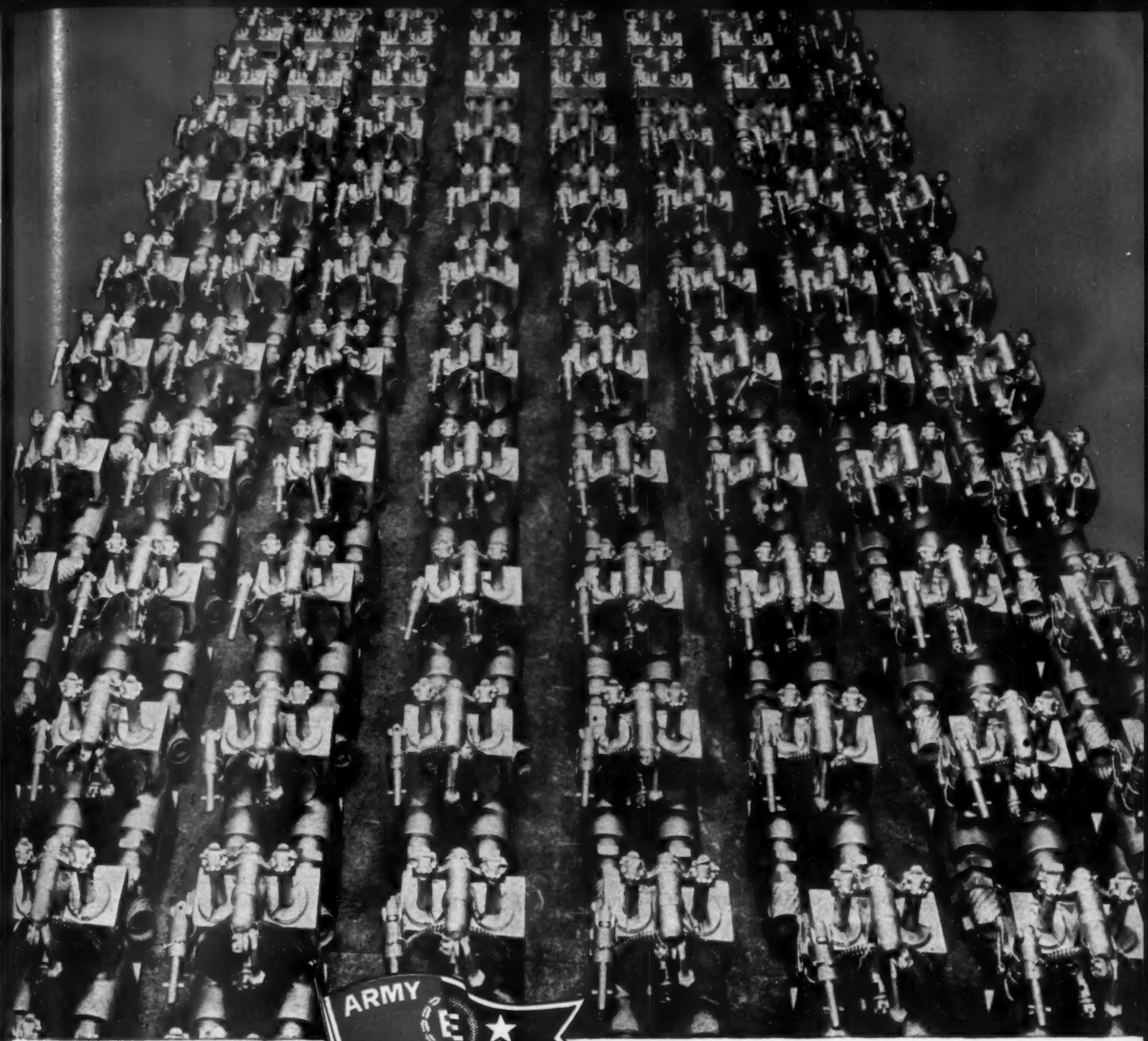

ARMY E NAVY

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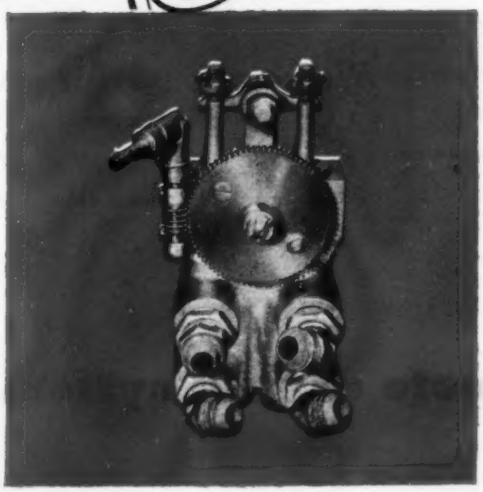

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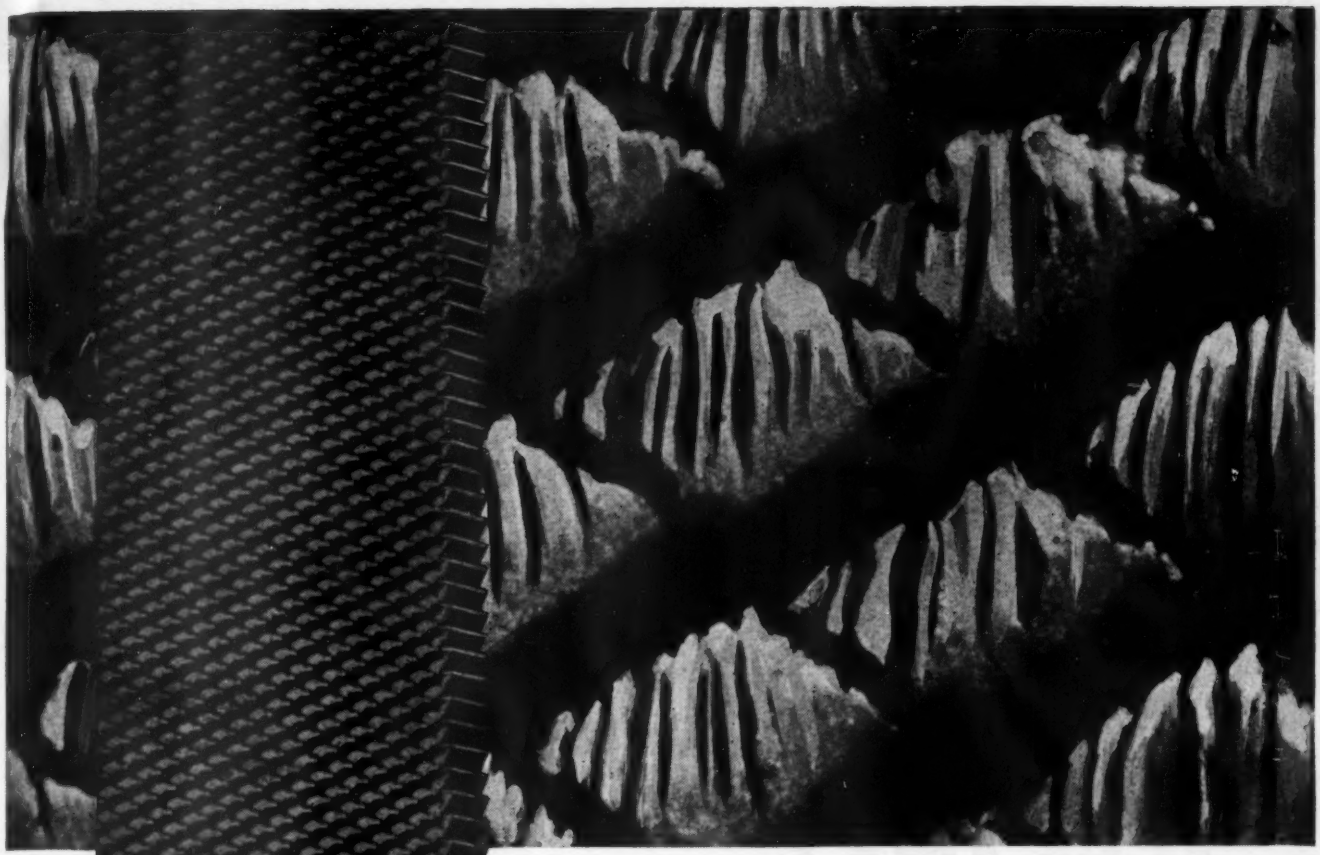

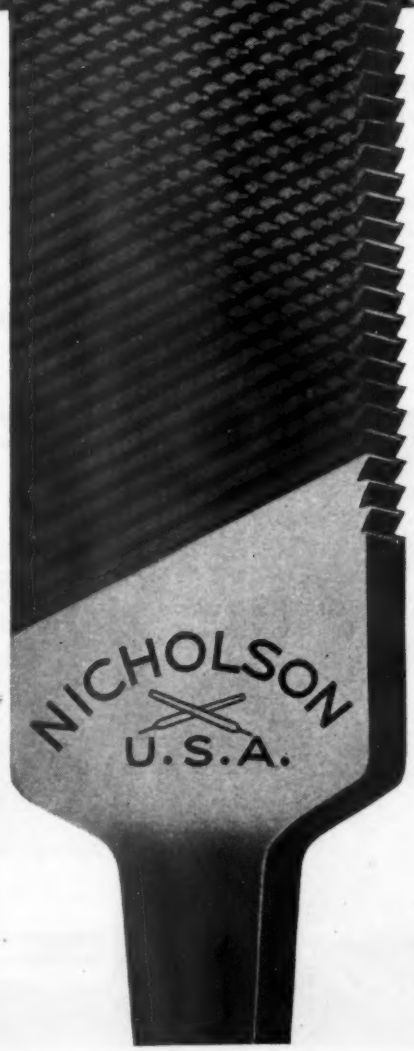

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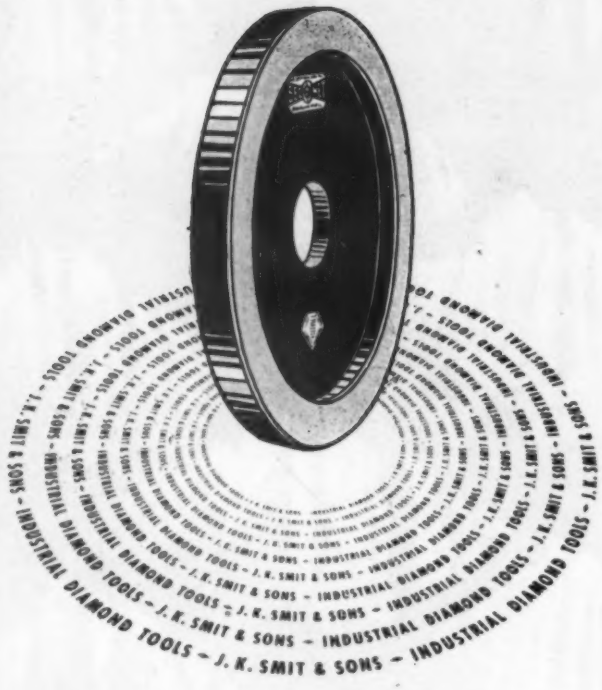

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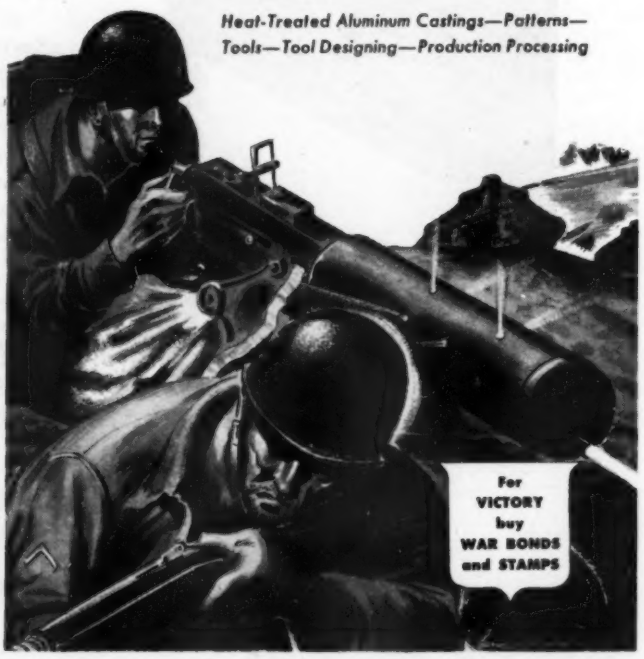

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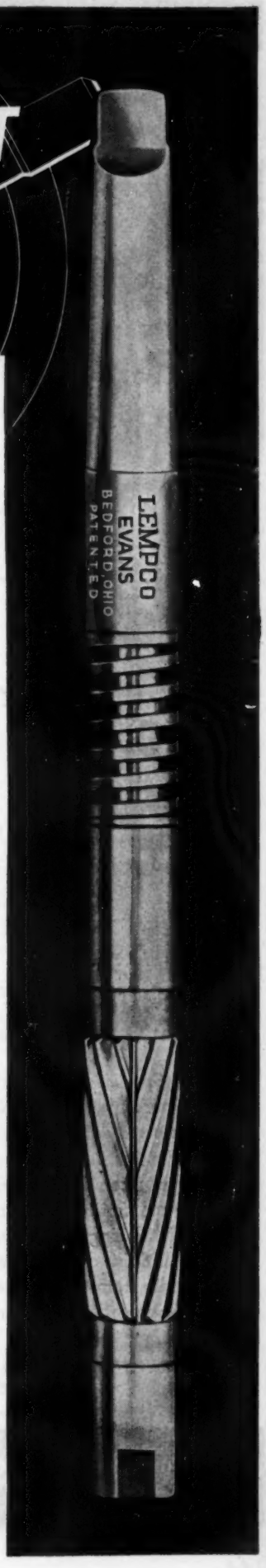

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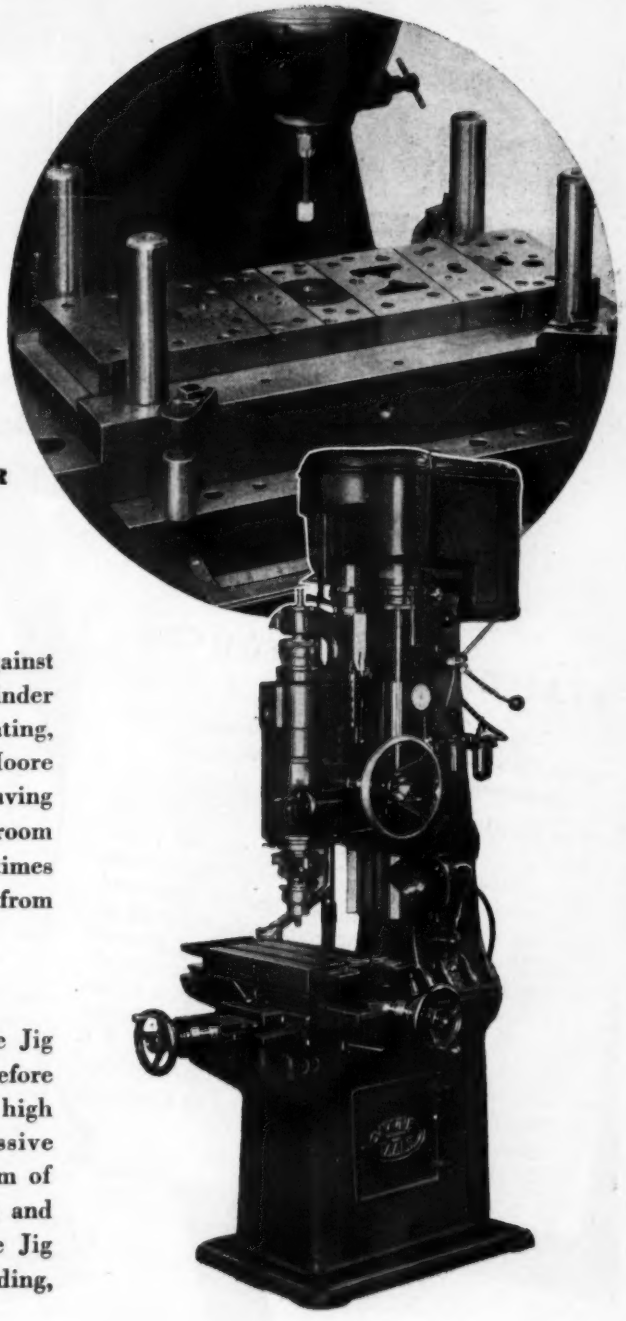

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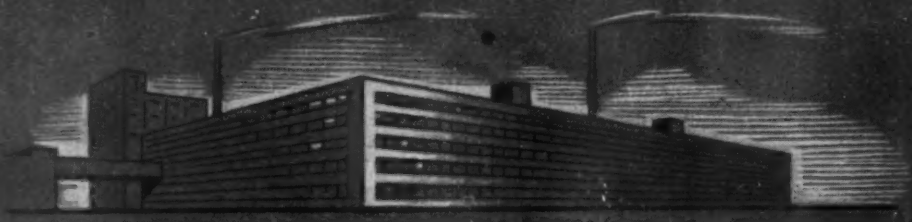

New 1943 Edition just published

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The fourth edition of The Taft-Peirce Handbook . . . a standard reference volume for manufacturing plants . . . is just off the press. In it you will find fully illustrated descriptions of the Taft-Peirce standard line of tools and machines. Many of these are unique . . . all of them have been tested in the proving ground of experience . . . because they were developed initially by Taft-Peirce master craftsmen to expedite and increase the accuracy of work in our Contract Manufacturing Division. The T-P Handbook contains complete mathematical reference tables, including Tables of Constants for the 5" Sine Bar.

Write on Your Company Letterhead for Either or Both of These Books.

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Design, Development, Tooling and Contract Manufacture of Special Machines, Tools and Products for Every Industry

This board-bound volume profusely illustrated in gravure is, in effect, a personally conducted tour through the plant which helps to "mind other people's business". In these pages you will see how Taft-Peirce meets the problems of design, development, tooling, and production for manufacturers of everything from automobiles to airplanes, machine tools to machine guns, hats to harvesters, foods to fabrics . . . whether they require a single tool or part, or production lots of complete mechanisms or machines. It will show you why manufacturers from all over the world . . . lacking facilities, experience, or specialized knowledge to cope with a design or production problem . . . just pack up their trouble and

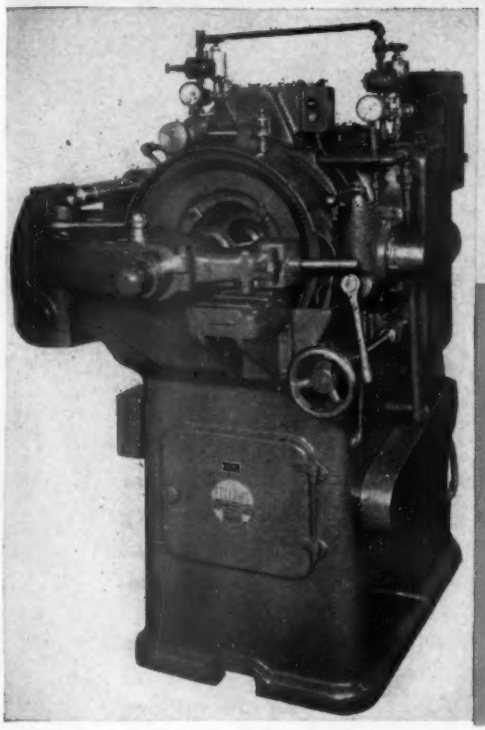
TAKE IT TO TAFT-PEIRCE

THE TAFT-PEIRCE MFG. CO.

WOONSOCKET, RHODE ISLAND

Providing Smooth, Chatter-free Operation for

FELLOWS GEAR LAPPING MACHINES

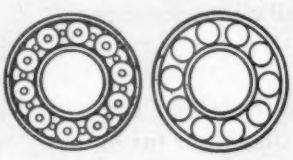


First requirement of a lapping machine is utmost evenness of running to prevent irregularities. In this Fellows LS type Gear Lapping Machine, the internal lap head is mounted on a 17" dia. Orange Staggered Roller assembly, which provides the smooth-running accuracy demanded by the external gear lapping operation performed on this machine.

ORANGE "STAGGERED" ROLLER BEARINGS

GREATER LOAD CARRYING CAPACITY

Orange Staggered Roller Bearings provide that rare combination every engineer looks for—extreme ruggedness, plus smooth, even, precision operation. The staggered roller arrangement distributes the load over a multitude of short rolls, rather than over a few full length rolls, as in conventional types.



Shown above are end views of an Orange Staggered Roller Bearing and a conventional roller bearing. Note how staggered design brings maximum roller surfaces in contact with the load.

This multiplicity of contact points within the loaded zone, insures an even-running bearing of greater load carrying capacity, enabling Orange Staggered Roller Bearings to do the work of larger conventional bearings . . . and to stand up longer under severest conditions. Full range of standard types. Special sizes to order. Write for Engineering Data Book.

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ORANGE • NEW JERSEY

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Over 2000 Stock Sizes
. . . enable you to make a further saving in time and money. Write for our new catalogue.

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Johnson LEDALOYL Bearings are ideal for any place where lubrication is hard to achieve, likely to be neglected, or where excess oil might damage goods in process.

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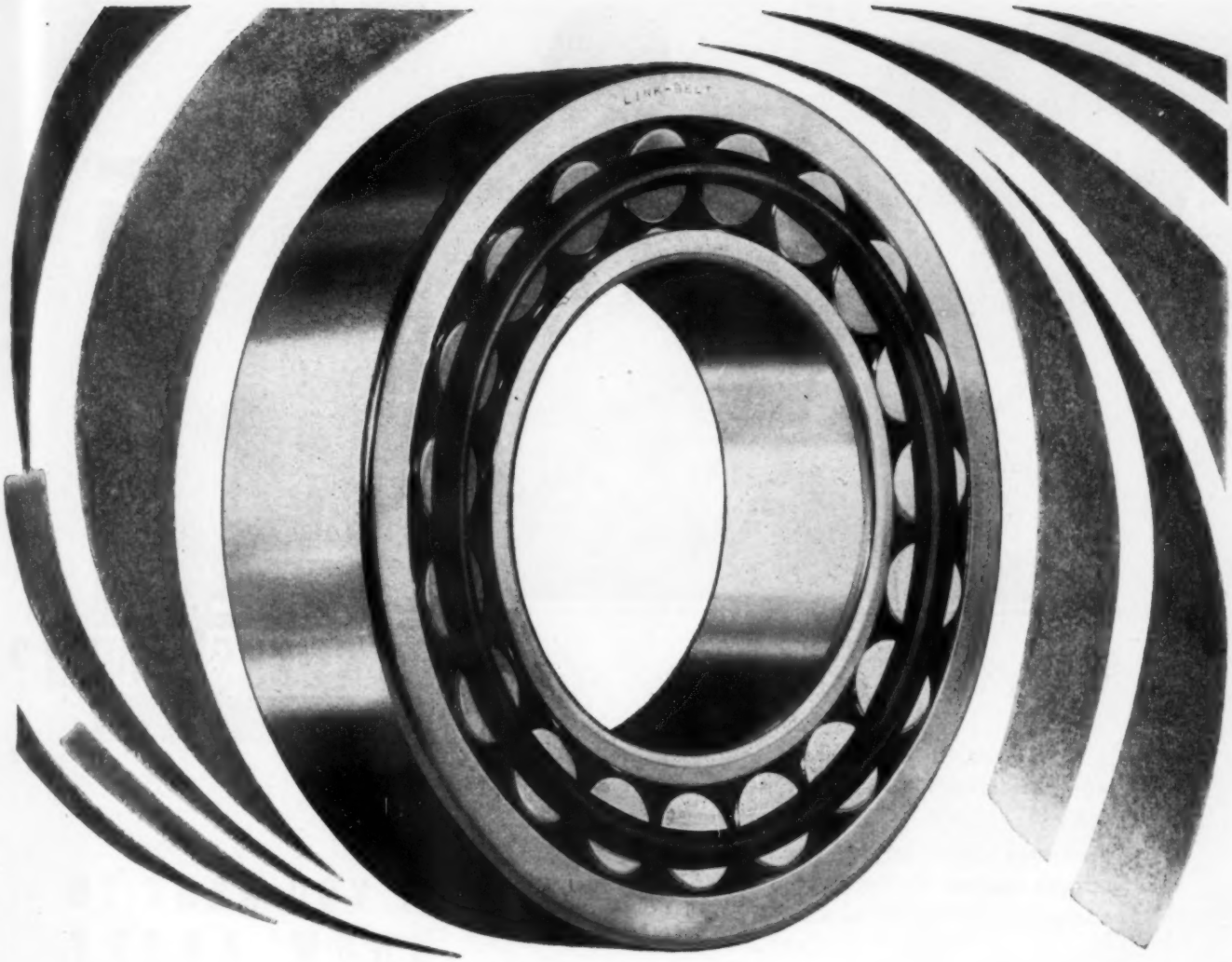

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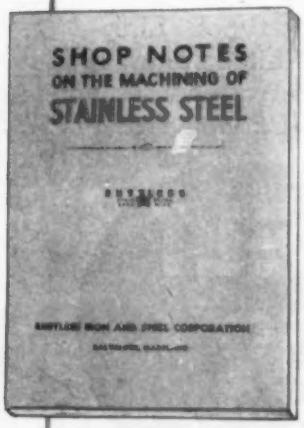

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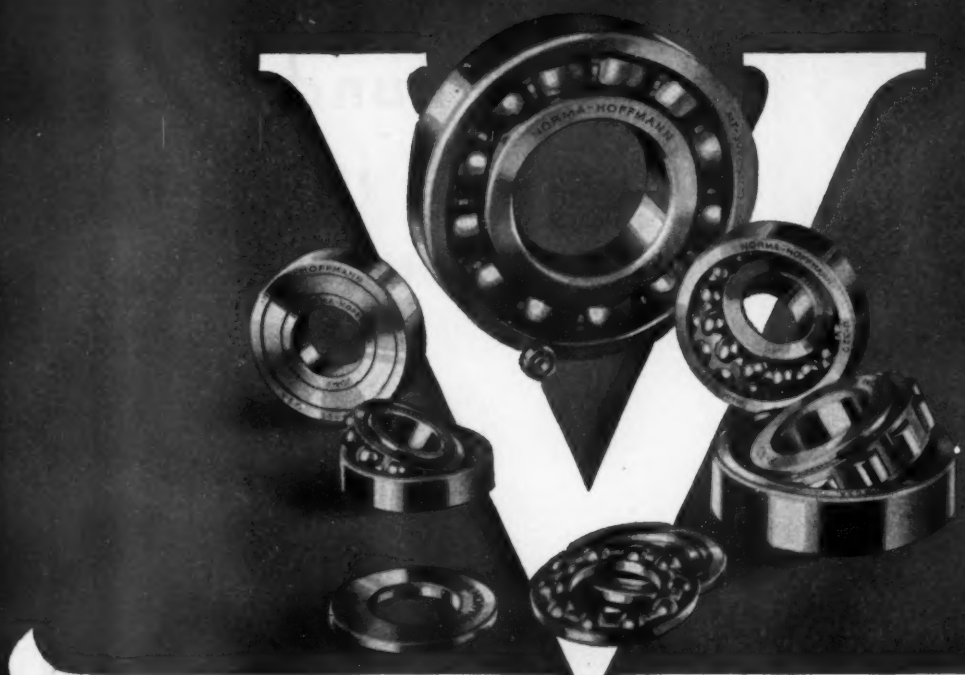

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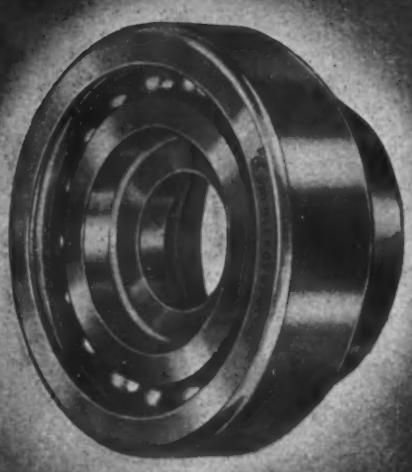

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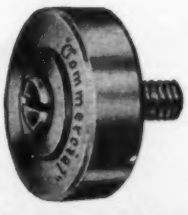

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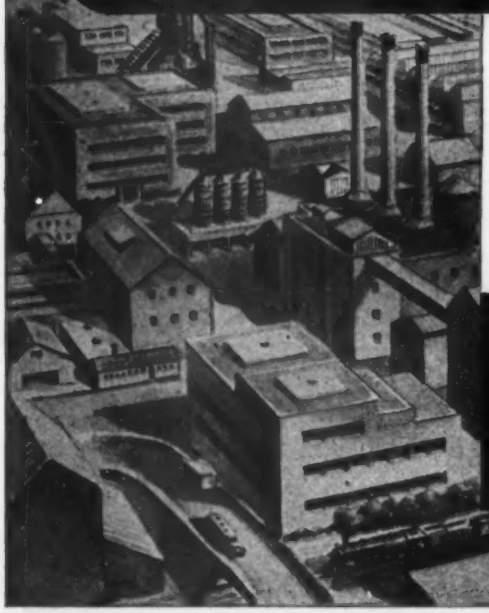

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Need Specialty Transformers that can take it?

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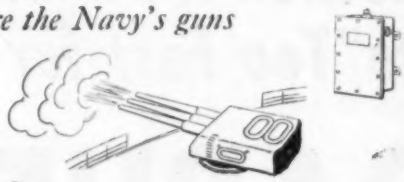
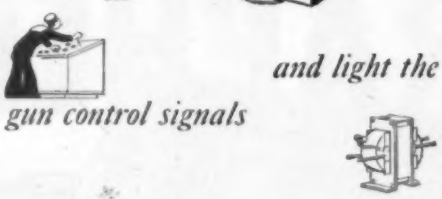


and light the gun control signals



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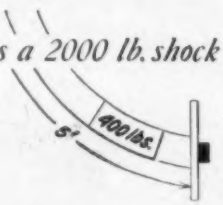

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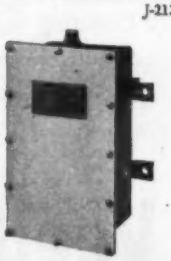

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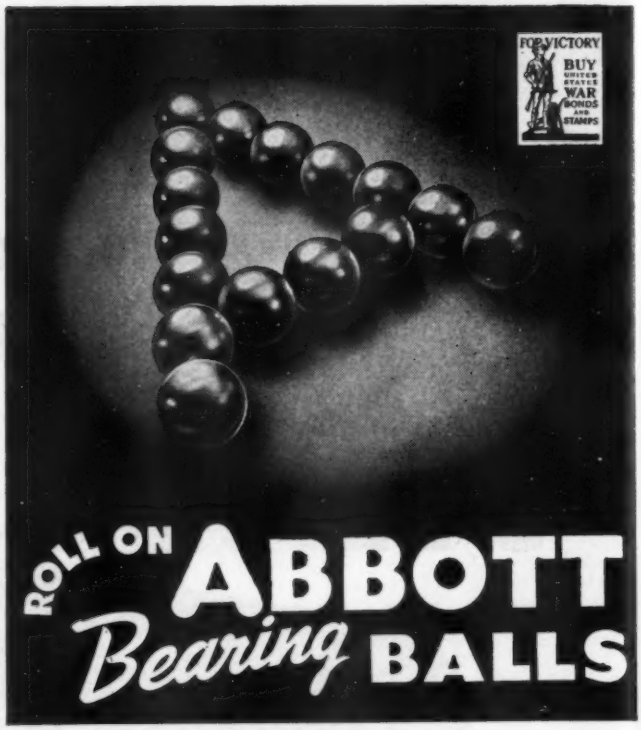

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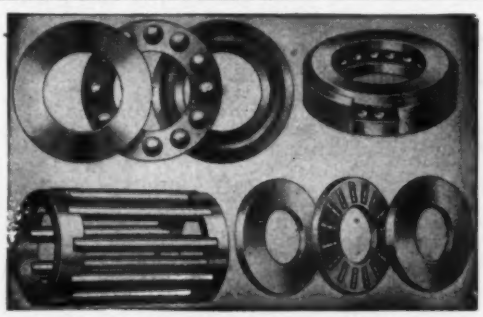

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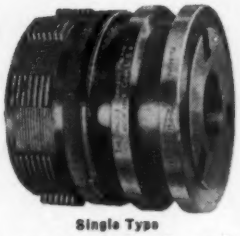

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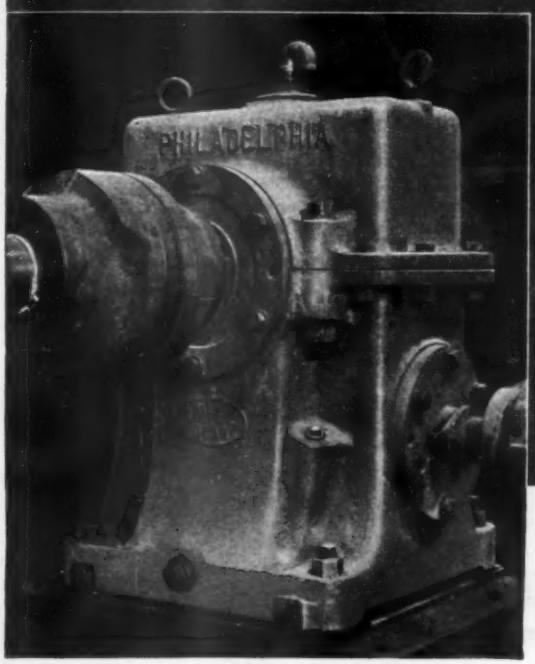

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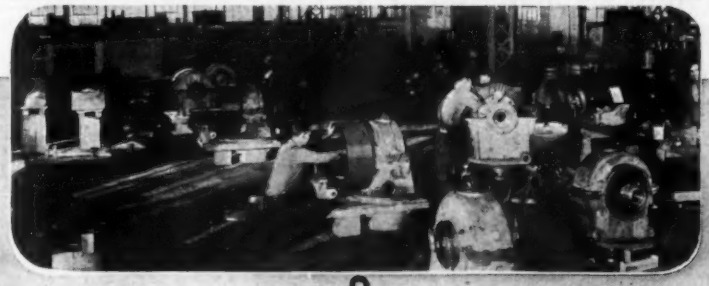

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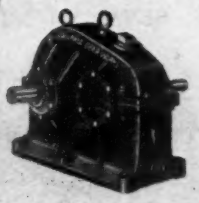

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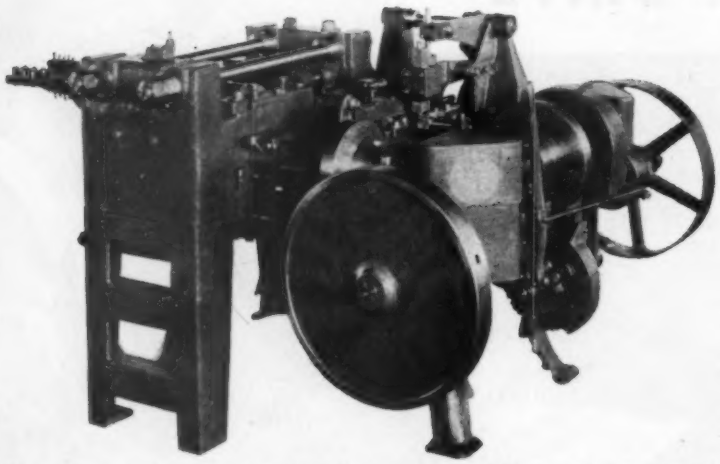
ON THE **NEW NILSON AUTOMATIC PRESS and FOUR SLIDE MACHINES**



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. . . for fast, heavy duty work

An outstanding feature of these combination power press and four slide machines is the powerful, silent action of the main press slide which is operated by crank motion through toggle or knuckle joints. Overhead stay rods contribute to the tremendous strength and rigidity of this machine.

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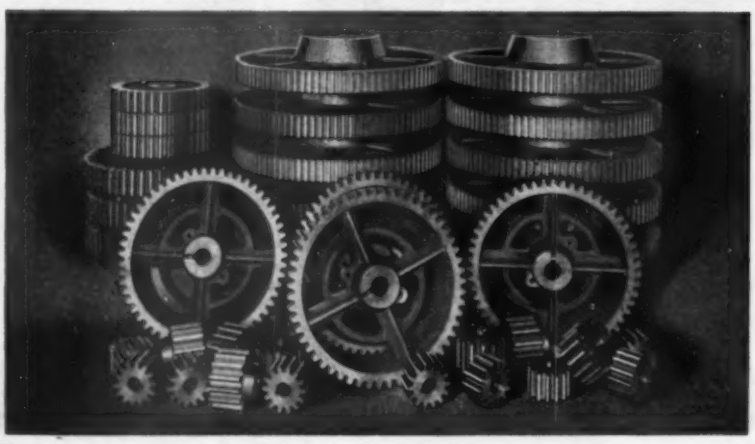

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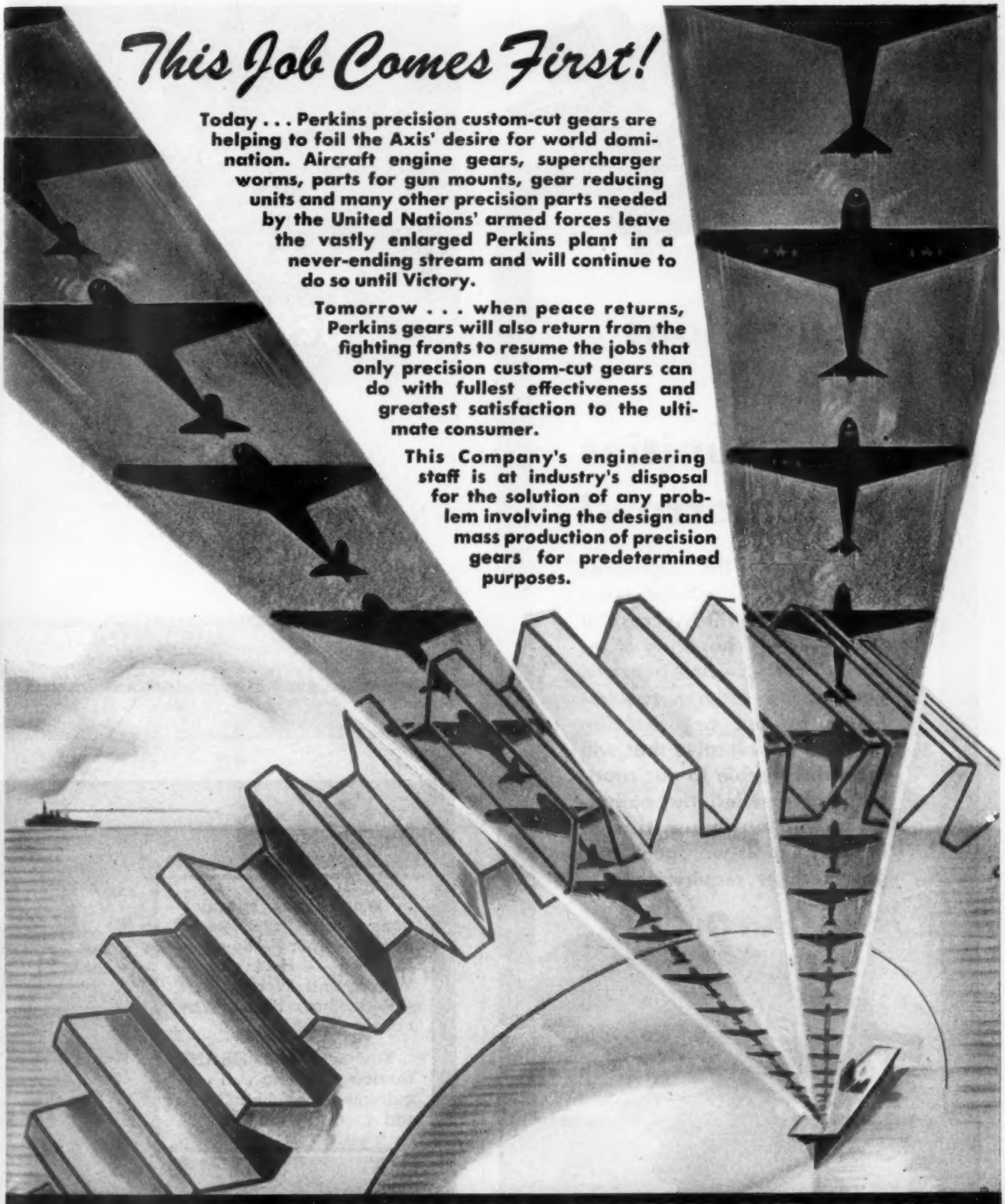
This Company's engineering staff is at industry's disposal for the solution of any problem involving the design and mass production of precision gears for predetermined purposes.



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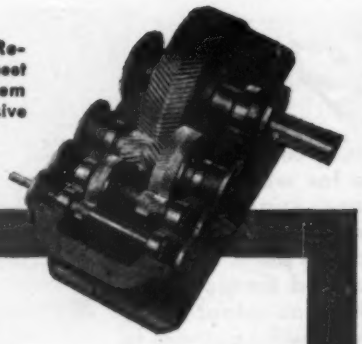

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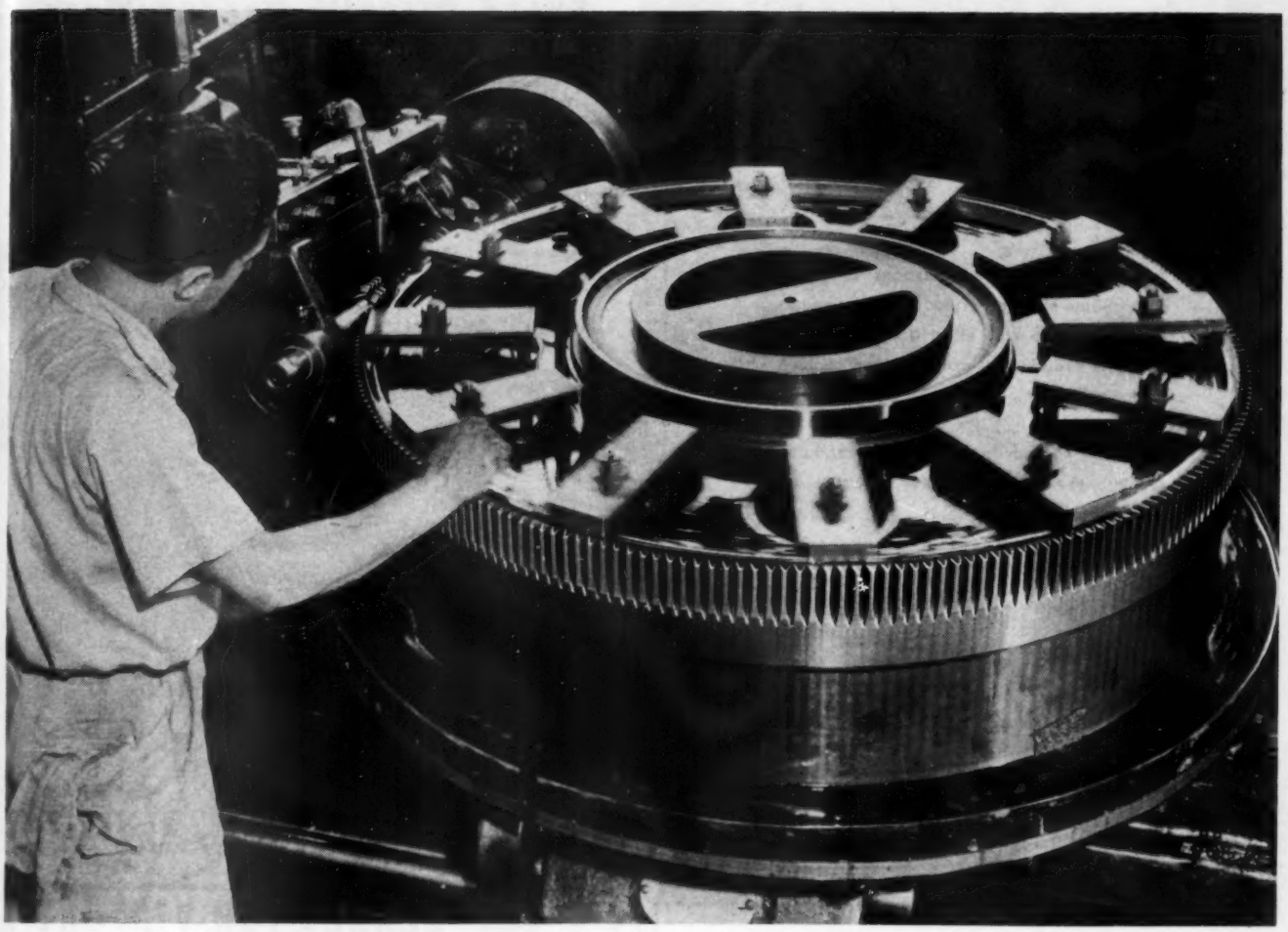

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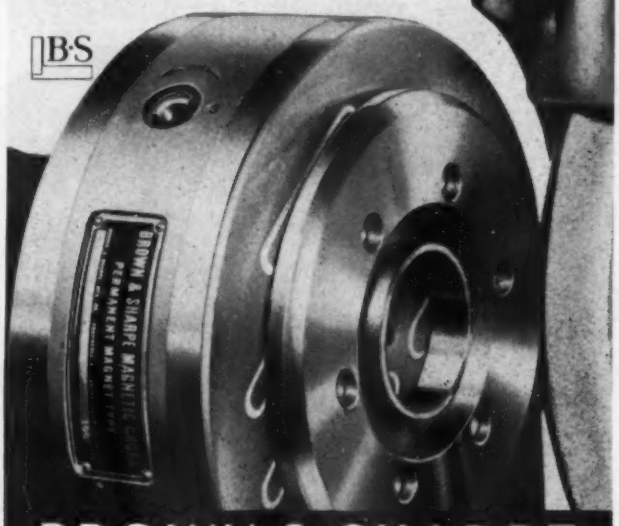

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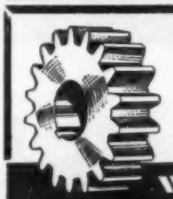

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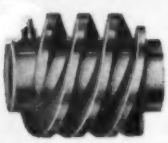

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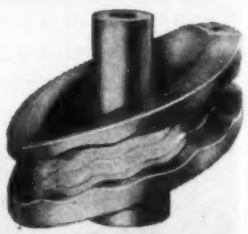

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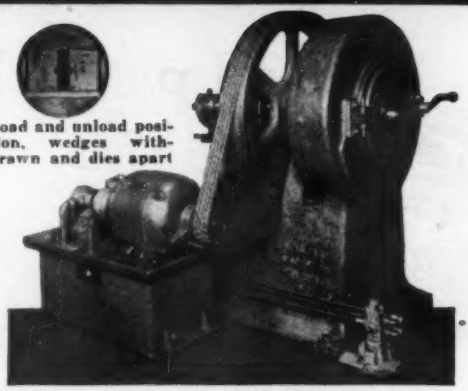
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In one operation, this machine connects tubing or cables to solid fittings, or forms metal sections from solid bars without cutting. A feature of its design is the use of hydraulically-operated wedges to compress the dies so that swaging force is applied at right angles to the work . . . not obliquely as with tapered dies. In reducing outside diameter of tubing, therefore, tendency toward elongation is lessened and thickness of tubing wall is increased. Fittings having large ends can be put into machine without removing dies. This machine simplifies handling of many other operations which previously required more complex, time-consuming methods.

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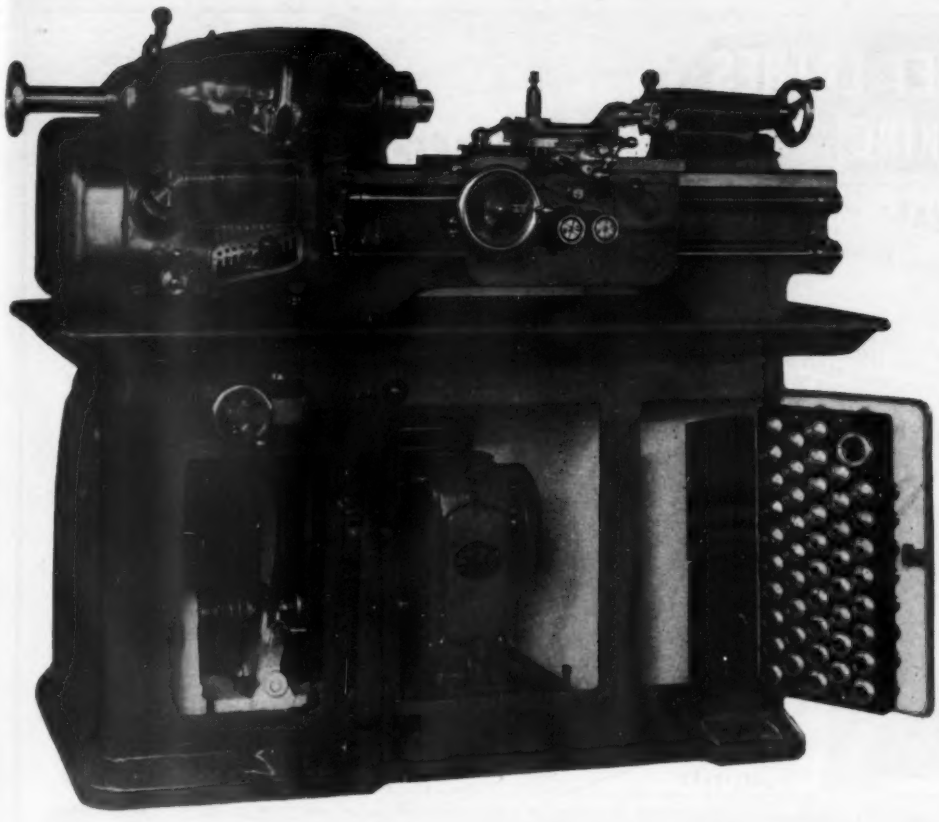

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TOOL AND GAGE MAKERS' LATHE

This is a high speed sensitive precision lathe, made to meet the demands for a lathe heavier and of greater adaptability than the standard bench lathe. It has a working range of spindle speeds of 40 to 2000 RPM., and it is important to note that ANY AND ALL SPINDLE SPEEDS ARE OBTAINABLE in this range.

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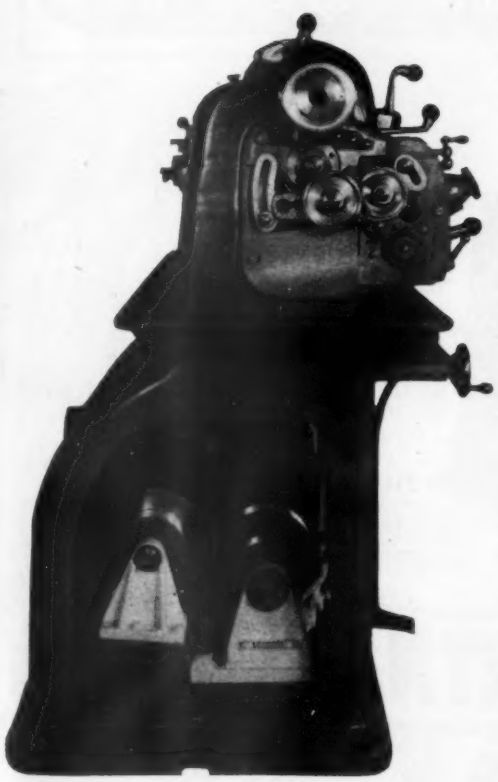

PRINCIPAL DIMENSIONS

Swing over ways	10¼"
Swing over cross slide	5½"
Center distance, nominal	18"
Range of spindle speeds,	40-2000RPM
Spindle Nose Cam Lock	D1-4
Hole through spindle	1½"
Maximum capacity of spring collets	1⅛"
Cross slide travel	5⅜"
Compound rest slide travel	2¾"
Size of tool	¾" x ⅜"
Approx. net weight of lathe complete with power unit	2480 lbs.

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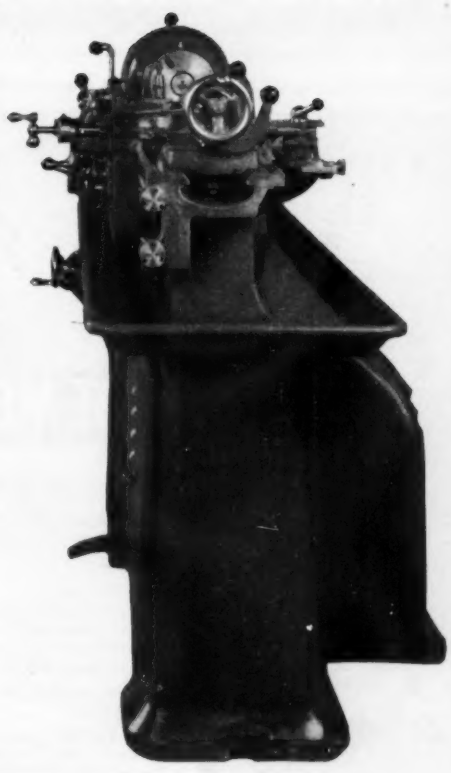
Large slotted face plate
Driving Plate
Micrometer carriage stop
Center rest
High speed centers
Thread chasing dial
Variable speed power unit
Chip pan
Necessary wrenches



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For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM. constant speed motor, 1200 RPM
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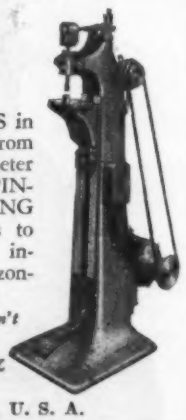

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This machine has increased production over 50 p cent over previous methods. Our engineers will b glad to discuss possible application of this method t your operation.

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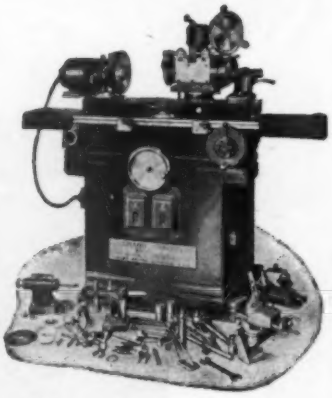

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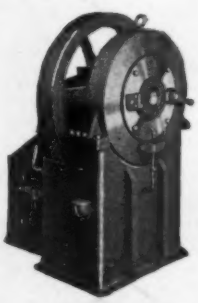

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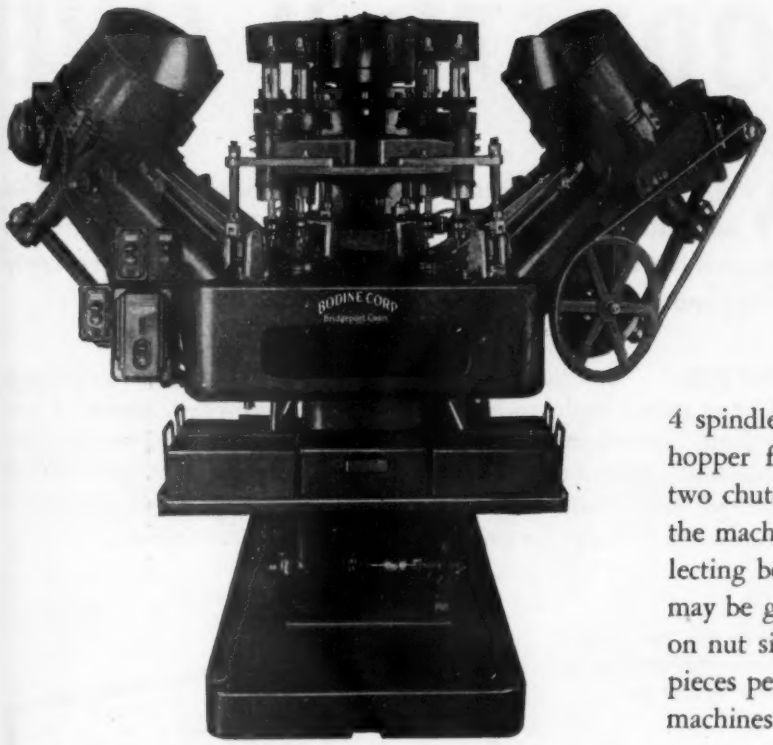

For Greater speed and closer accuracy in production of nuts, up to ½"

A completely motorized, self contained unit for high speed precision nut tapping is now available to qualified buyers . . . and is also destined to fill many demands for post-war production.

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Production speed is developed by means of 4 spindles to which the nuts are delivered thru two hopper feeding mechanisms — each hopper carrying two chutes. Thus 4 nuts are tapped at one stroke of the machine and discharged into their individual collecting boxes so the product of each tapping spindle may be gauged prior to delivery to stock. Dependent on nut size and material, production will run to 160 pieces per minute on the smaller of the two standard machines.

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Because the tapping spindles are driven through a positively geared and timed train of gears, (no friction clutches) there is no tendency to distort or tear the threads in the tapped hole. The supporting hardened and ground flat plate insures tapping square with face of the nut.

PROVISION FOR ADDED OPERATIONS

If countersinking and tapping — or drilling, counterboring and tapping are desired on a nut, Bodine design arranges to hopper-feed the blanks to an indexing dial which carries them to multiple spindles for successive operations. One operator, in this instance, can oversee a battery of Bodine machines.

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The No. 40 Machine handles nuts to ¼-28 and the No. 48 to ½-20. The smaller requires a floor space 80" x 55", the larger, 80" x 80".

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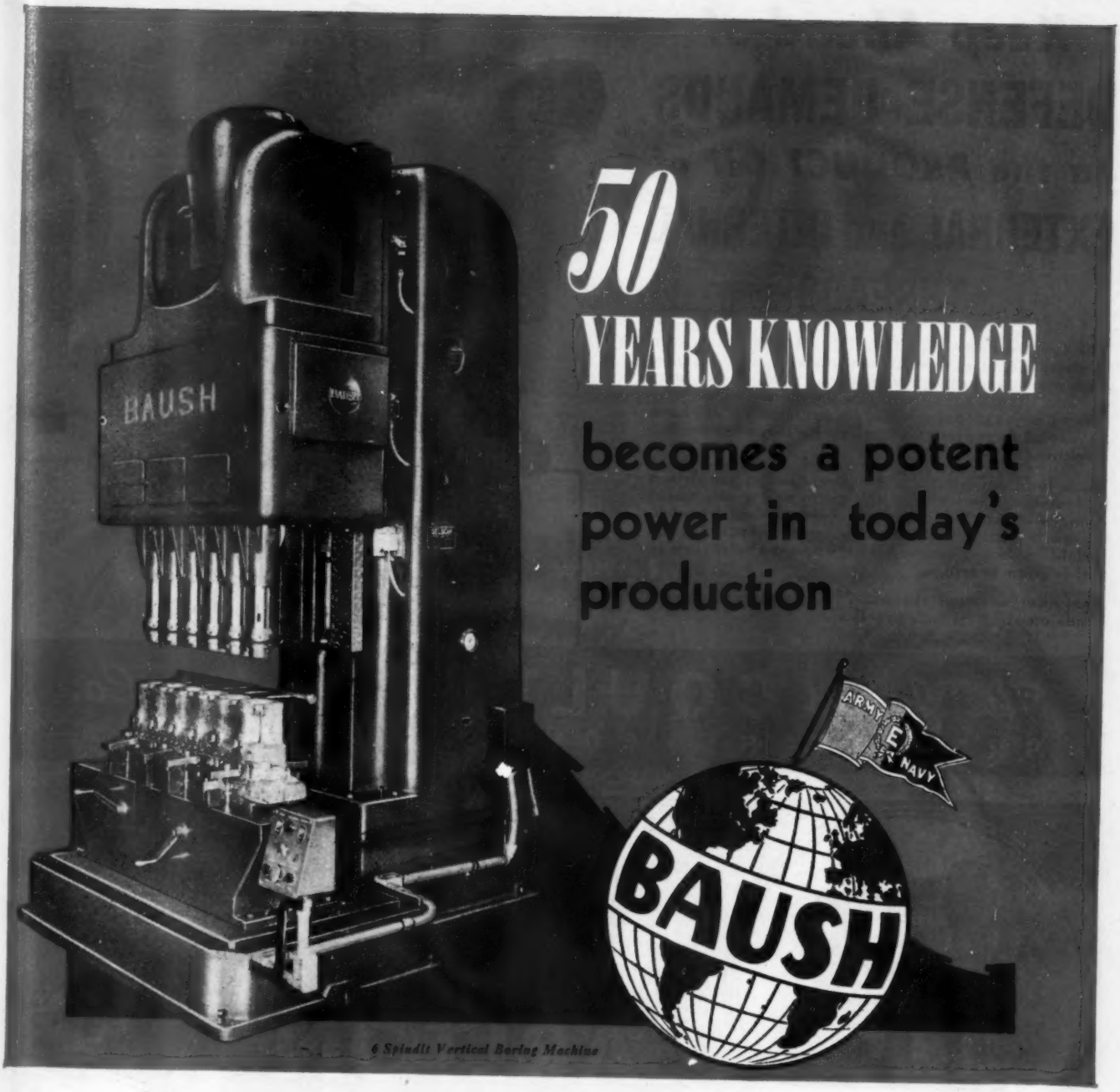

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* The knowledge and specialized experience of Baush over a period of fifty years has been applied to Multiple Spindle Drilling, Tapping and Boring Machines as well as special equipment.

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DEFENSE DEMANDS
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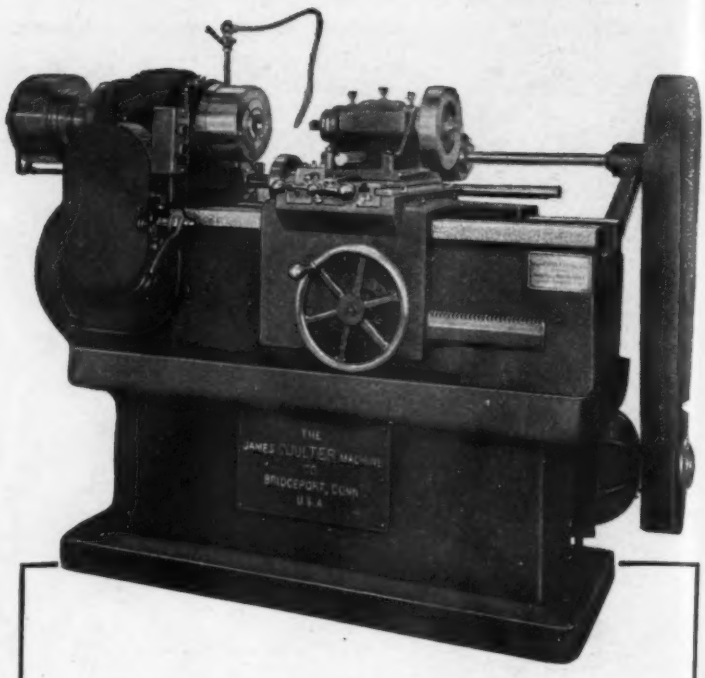
The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

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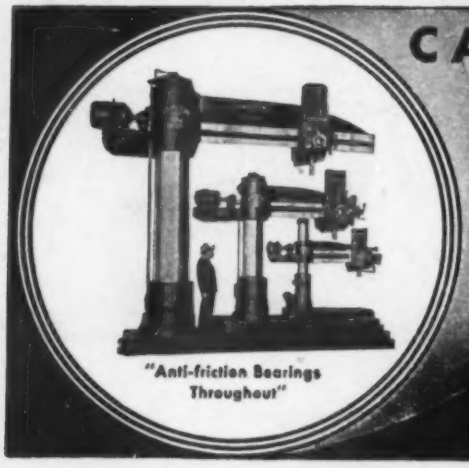

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FEATURES— 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

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Gears—precision cut, tempered and ground . . . Spindle—mounted on Roller Bearings to resist any combination of thrusts . . . Bed—extra heavy in construction . . . Ways and carriage hand scraped to a precision bearing. These features of Cincinnati Lathes add up to accuracy in every detail that insures precision results on every job. Write for complete specifications on 14" to 30" sizes to produce your work always most economically.

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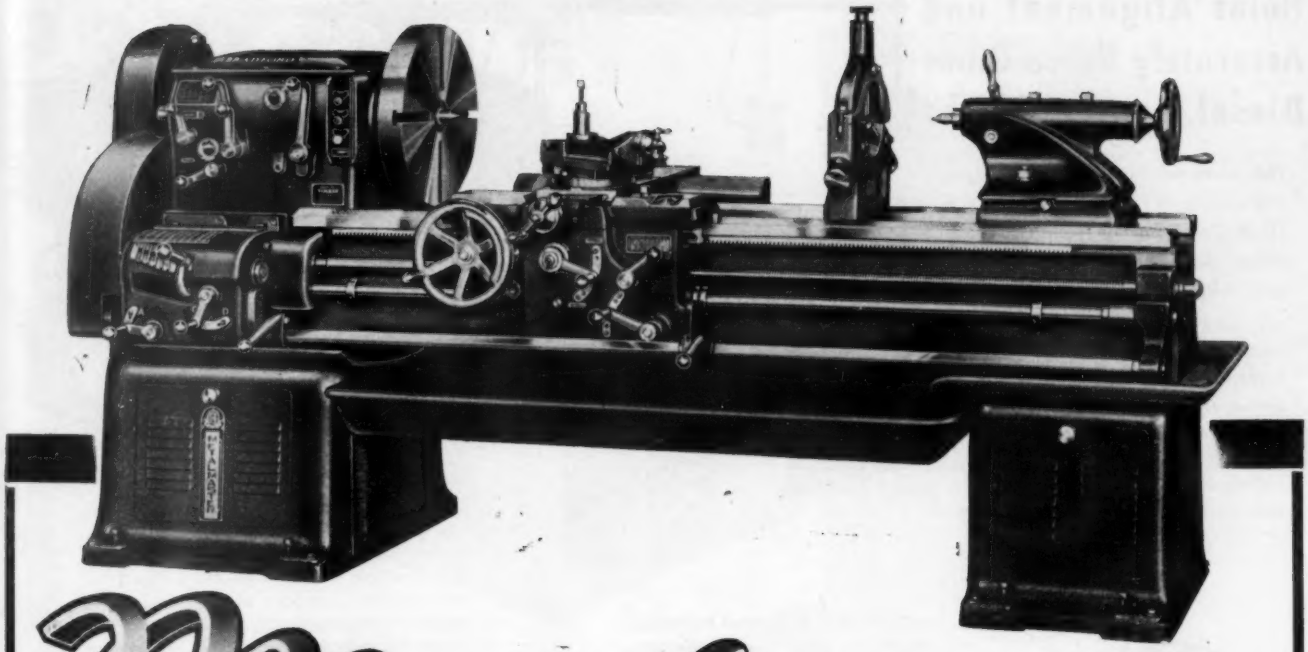
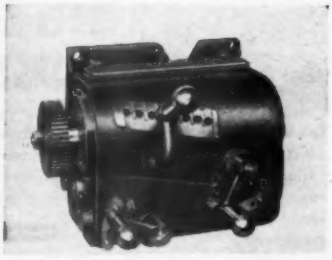
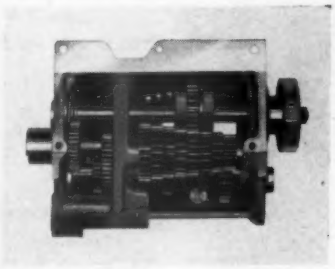
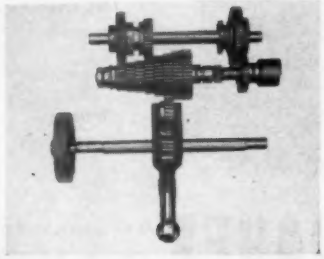


Metalmaster







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● Bradford is proud to have pioneered one of the most valuable contributions to modern lathe design — the Quick Change Feed Box. Today, the METALMASTER Lathe offers a Quick Change Feed Box offering 64 speed changes, ranging from fine to coarse. A direct reading index plate shows the position for the conveniently located shift handles for all threads and feeds, including 11½ threads. All sliding gears have pointed teeth and are mounted on ground, splined shafts, equipped with integral keys, to facilitate easy engagement. A semi-steel idler gear, mounted on roller bearings, connects the feed box to the head gearing. This gear is easily replaced by special compounding or translating gears, for cutting odd threads not included in the regular range, or for metric pitch screws.

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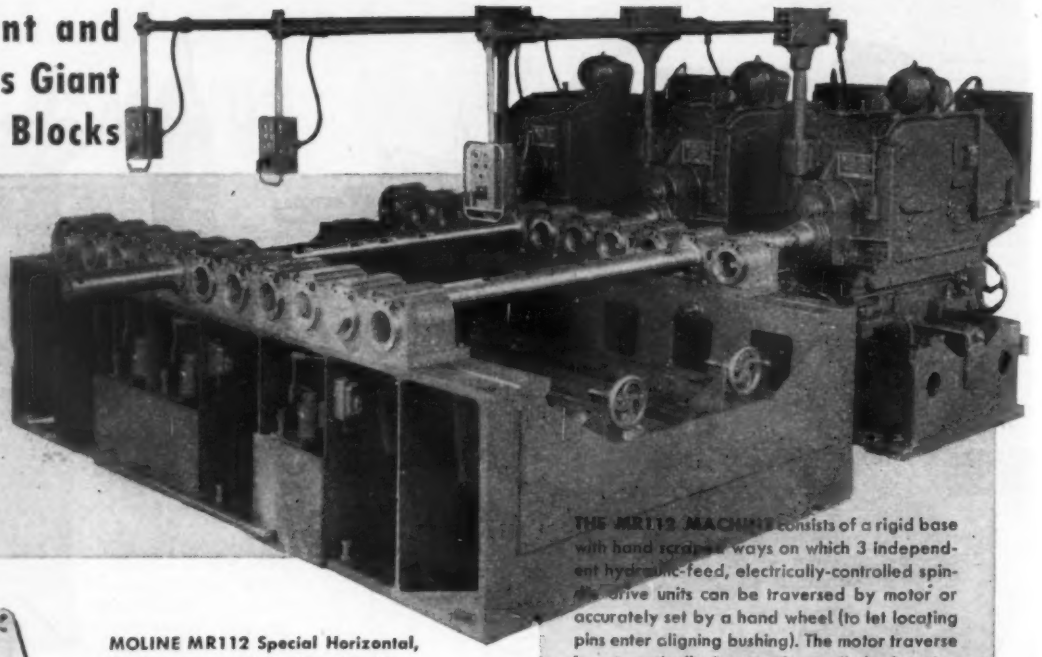
659 EVANS AVE. . . . CINCINNATI, OHIO

Holds Alignment and Accurately Bores Giant Diesel Engine Blocks



This immense horizontal unit consists of two parts: (1) A 3-unit Boring Machine; and, (2) A Holding and Aligning Fixture.

THE FIXTURE holds the work (large Diesel engine cylinder blocks), and supports a double row of properly spaced, aligning bushings which in turn support the multiple boring bars and hold the bars in alignment.

THE MR112 MACHINE consists of a rigid base with hand scraped ways on which 3 independent hydraulic-feed, electrically-controlled spindle drive units can be traversed by motor or accurately set by a hand wheel (to let locating pins enter aligning bushing). The motor traverse is automatically inoperative until the locating pin is withdrawn, also if units get too close to each other or to the ends of the base. Three individual electric control stations are mounted on movable booms which permit operation from any point and permit several operators to work with the units at the same time. The drives are 2-speed, and the change from "roughing" to "finishing" speed is by means of a lever operated clutch.

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MOLINE MR112 Special Horizontal, Hydraulic Feed Boring Machine.

If you need boring, reaming, honing, drilling or tapping equipment MOLINE is your logical source. Write for bulletins on MOLINE Machines.

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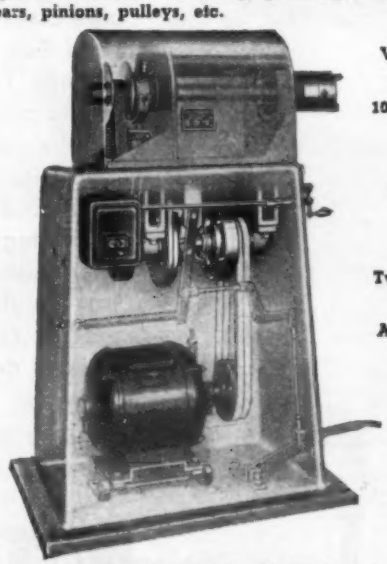

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PRECISION
TOOL AND CUTTER GRINDING
"The Oliver Way"

These cuts illustrate the Oliver Ace Tool and Cutter Grinder as regularly supplied for sharpening the general run of milling cutters. The large cut (above) shows the machine with centers in place for grinding hobs, reamers, staggered tooth cutters, shell mills, etc. The small cut (left) illustrates the adjustable Timken Bearing Head with taper for mounting end mills and similar cutters with shanks.

Note the simplicity of setup . . . . the ease with which angles are obtained . . . . and the possibilities for rapid production of individual cutters or quantities of similar cutters.

This is the machine you have heard so much about—the machine the cutter manufacturers are using in quantity to break the bottleneck in the production of milling cutters.

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Here is a versatile machine that will help you to produce precision gears on an uninterrupted schedule.

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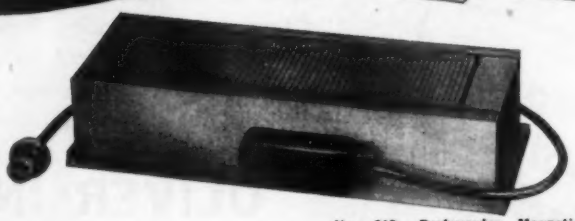
Our illustrated bulletin W4 contains valuable information for user of magnetic chucks. Write today. Ask Walker engineers to help you select the chuck you need for your specific service.



No. 618. Rectangular Magnetic Chuck. Sizes range from 4"x8" up to 30"x90"

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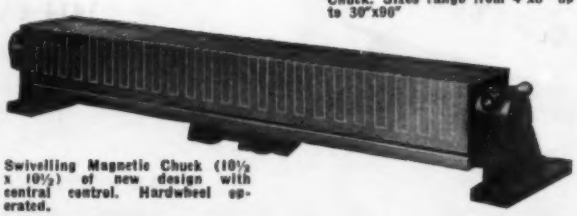

Swivelling Magnetic Chuck (10½ x 10½) of new design with central control. Hardwheel operated.

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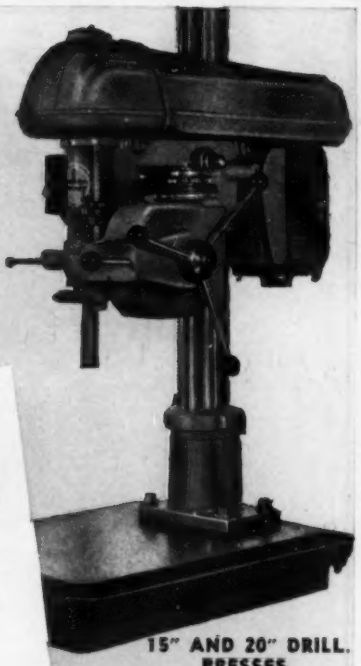

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Bench and floor models. Hand or power feed. Spindle speeds 260 to 5200 r.p.m.

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THERE is not an idle pound in a Walker-Turner Machine Tool. Weight conservation is the result of careful design and discriminating selection of materials. The result is a group of machine tools of unique characteristics: flexible, rugged, capable of wide variations in speed for cutting various materials, simple, safe, easy to operate without fatigue.

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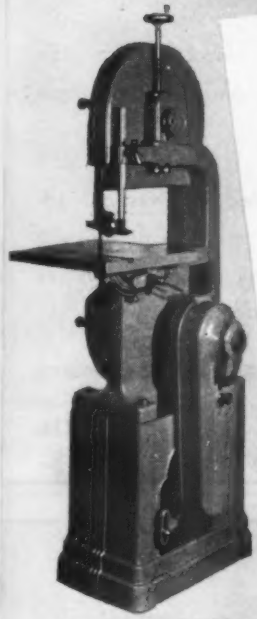

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For burring, polishing and hand-lapping operations.

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Handles light drilling, and tapping Drills to center of 62" circle. Spindle speeds 160 to 8200 r.p.m.

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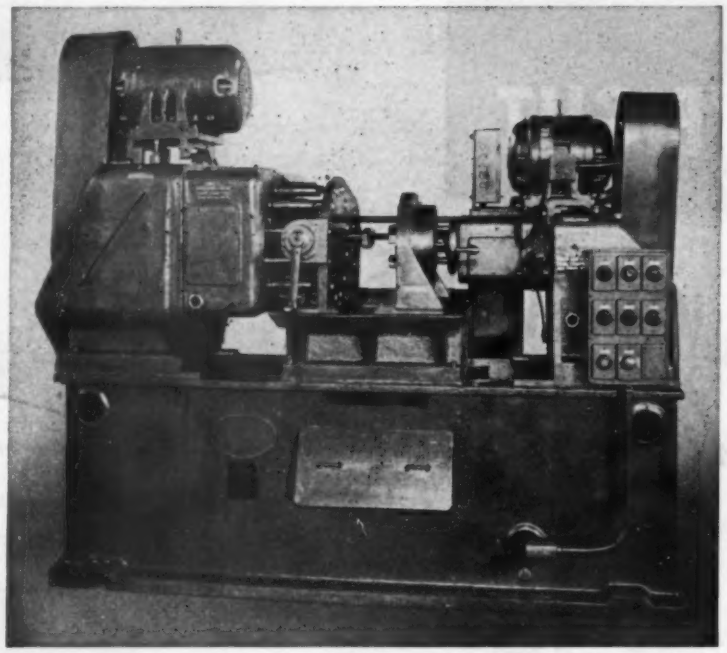
MULTIPLE SPINDLE
DRILL and TAP HEADS



put your idle machines on the production line

A base and motors brought out of storage and retooled with a holding fixture;

A 19-Spindle Tapping Head on Left Side and an 8-Spindle Tapping Head on Right Side.

All spindles are provided with vertical adjustment to secure proper tap depth, and each head has an oil pump for positive lubrication and freedom from wear.

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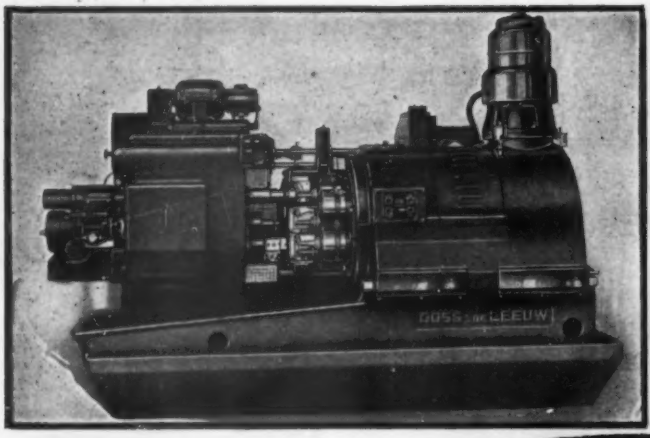
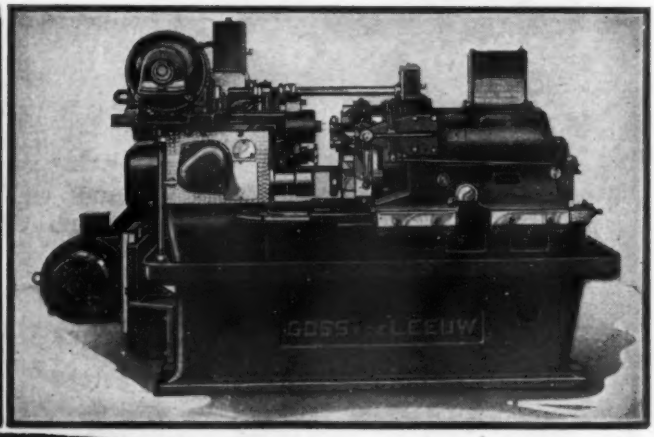
Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

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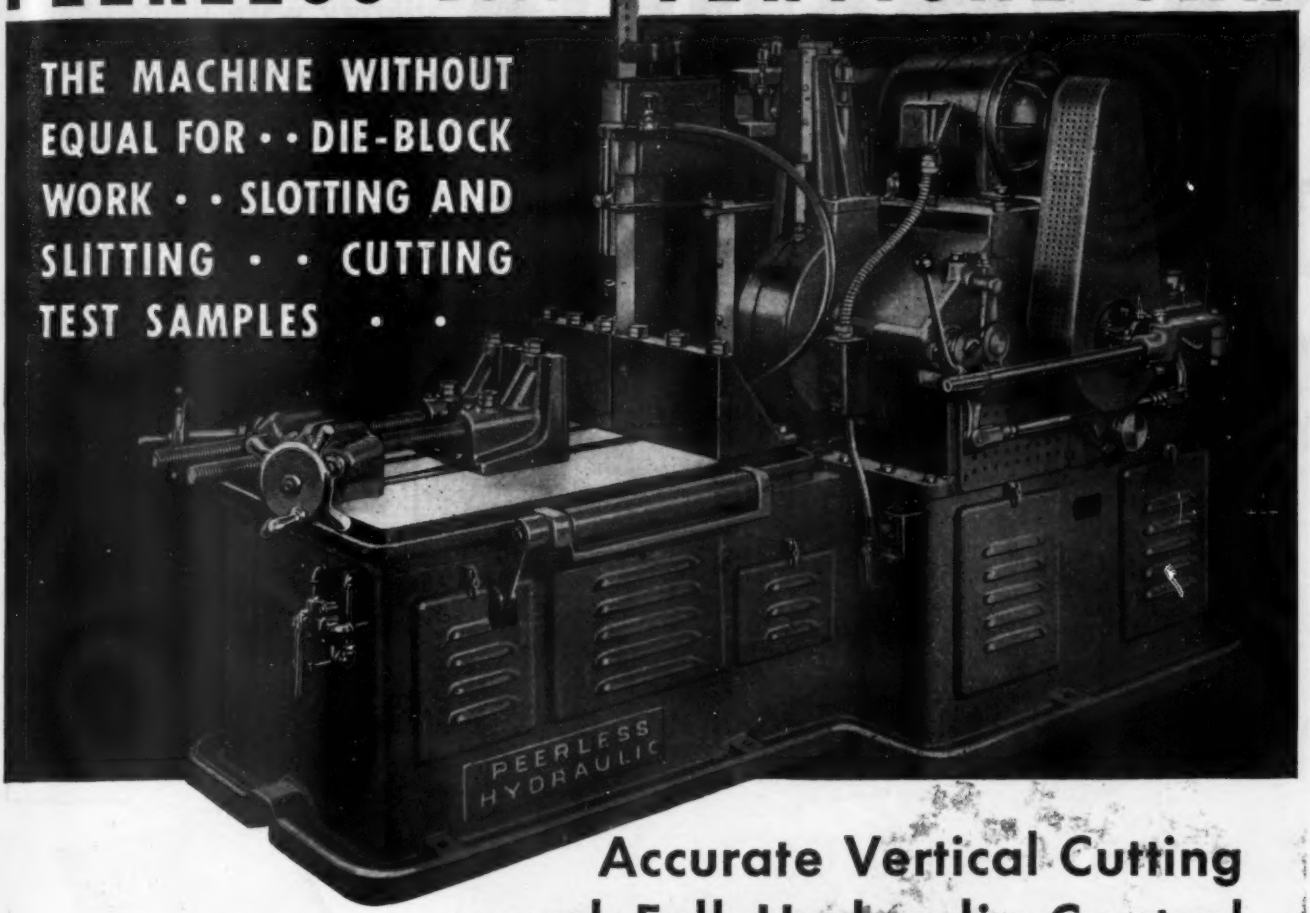

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Fast ACCURATE *Sawing* DEMANDS PEERLESS BLADE CONTROL

Sommerfeld

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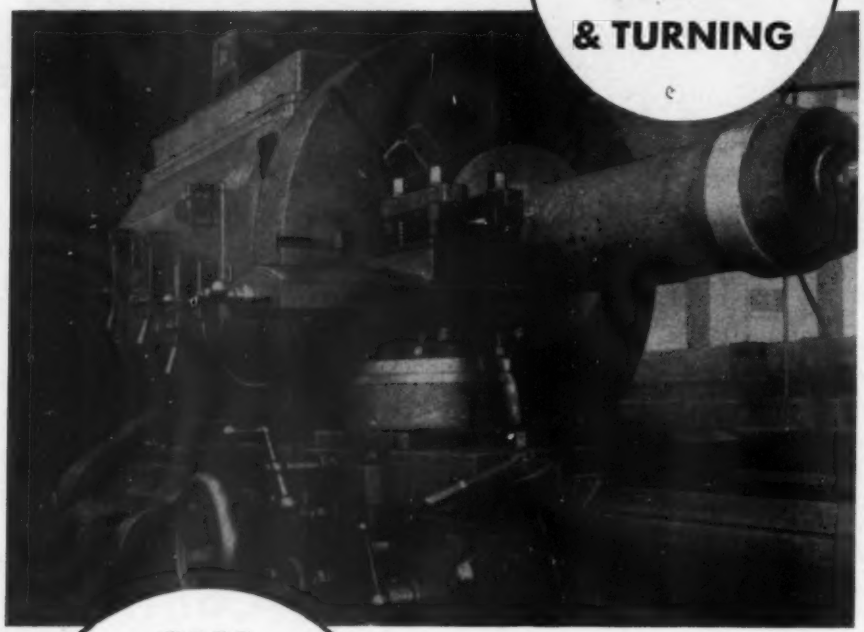
LATHES

TURNING
* * *
BORING & TURNING



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Preliminary turning of the rough bar stock

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Turning the teeth for the huge broach

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The LAPOINTE

High

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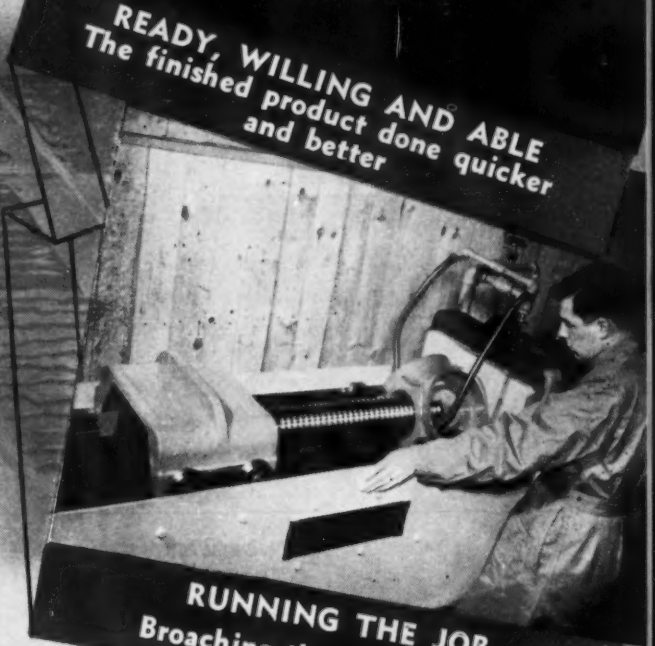
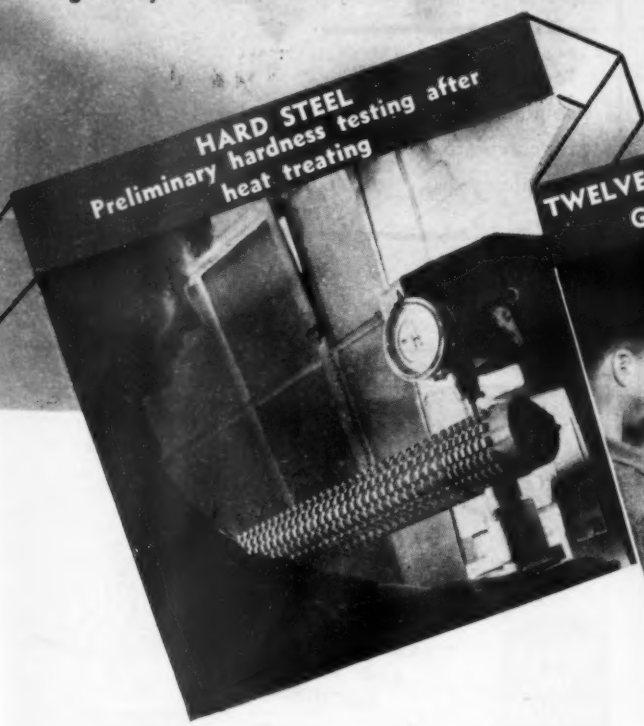
The finished product done quicker and better



RUNNING THE JOB
Broaching the propeller hub



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Preliminary hardness testing after heat treating

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Grinding the splines in propeller

Machine Tool Company ★ ★

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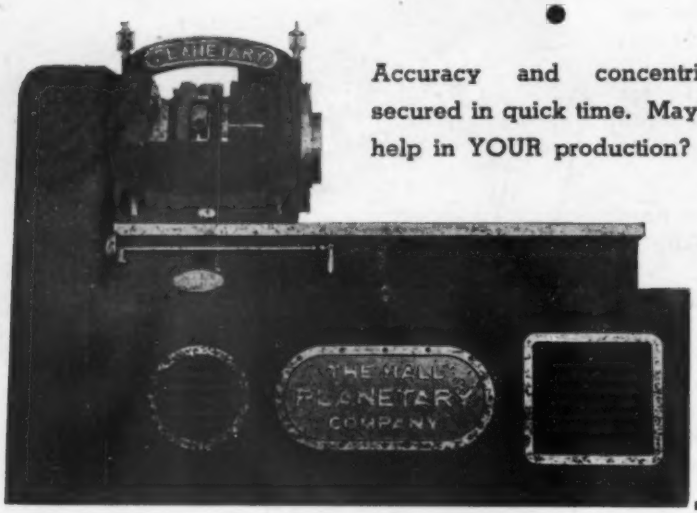

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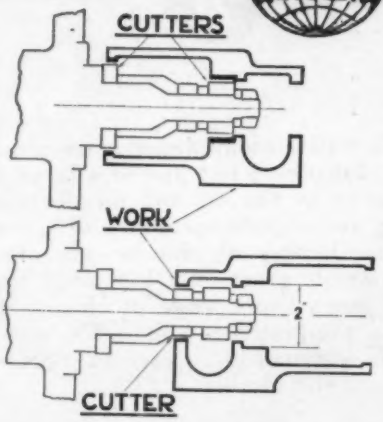
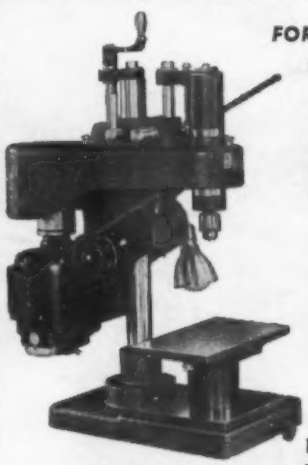


PLANETARY MILLER

The
HALL PLANETARY CO.
Fox & Abbotsford Ave.,
PHILADELPHIA,
PA.



FOR GREATER SPEED RANGE, SENSITIVITY AND EASE OF OPERATION . . .

HAMILTON
"VARIMATIC"

. . . SUPER SENSITIVE, VARIABLE SPEED DRILLING MACHINES!

★

LOW RANGE
Min. Spindle Speed 840 — Max. Spindle Speed 2700

HIGH RANGE
2900 — 9300

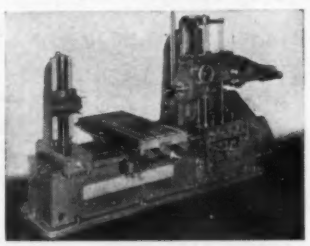
DRILL CAPACITY
.004" to 5/16"

Here's a unit built with "instrument precision", fully capable of handling the finest work for both defense and peacetime production. Combining sensitivity and ease of operation, the "VARIMATIC" allows instantaneous, variable speed adjustment in two ranges. (Speed changes are accomplished by means of a hand wheel. A graduated dial on hand wheel shows the speed at which the spindle is operating.) A letter will bring complete details—write!

The Hamilton Tool Co.
830 NINTH ST. HAMILTON, OHIO

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.

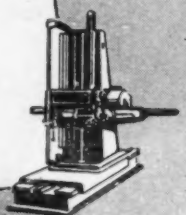


Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

GILBERT

PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES



DETAILS ON REQUEST

THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

Stop AT THE LINDBERG PLANT

. . . during your visit to the National Metals Congress at the Palmer House in Chicago, October 18 through the 22nd. We will be pleased to greet you in Room 765 at the Palmer House and conveniently arrange your trip to the plant.

★ A cordial invitation is extended to all our friends to see the step by step construction of many sizes and types of Cyclone, Super-Cyclone and Hydryzing furnaces as they move through the shop ★ The new line of Laboratory furnaces and equipment, recently announced, will be on display for your examination. You will find them different and interesting ★ Too, Lindberg's famous Input Control and Throttling Control are here for those who wish to see their operation and advantages.

There is more to see and a lot to talk about—we will be looking forward to seeing you the week of October 18—Room 765, Palmer House, Chicago.

LINDBERG ENGINEERING COMPANY
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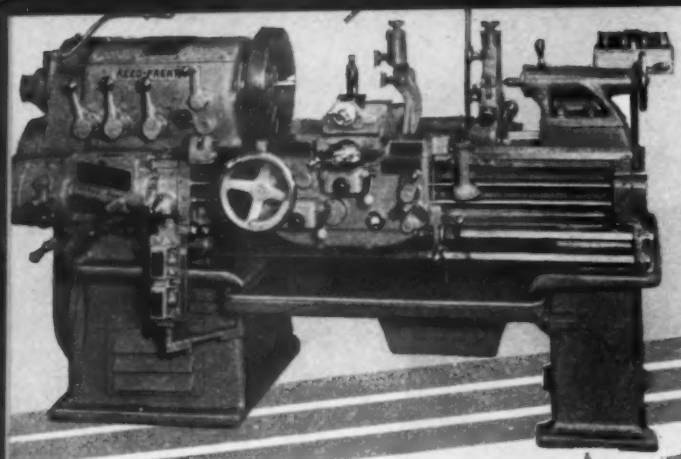
LINDBERG FURNACES

ARMY E NAVY

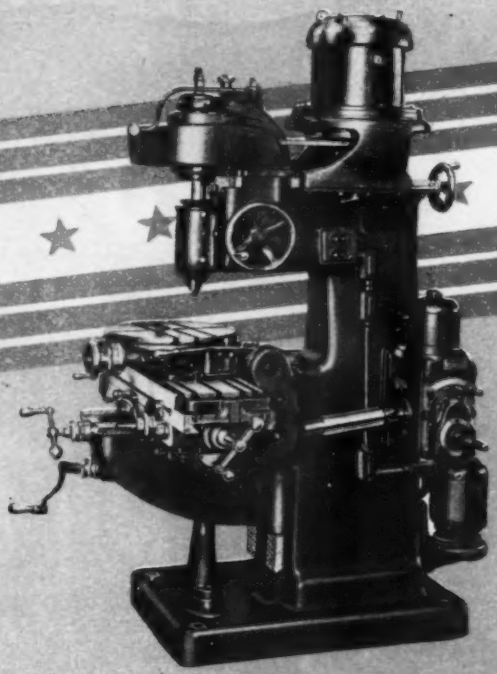
SUPER-CYCLONE for hardening, normalizing, annealing, tempering

CYCLONE for accurate, low-cost tempering and nitriding

HYDRYZING for scale-free and decarb-free hardening

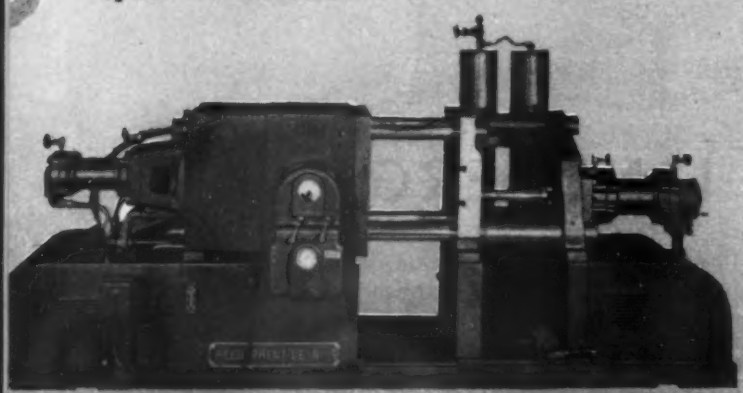


14", 16" and 20" Engine and Toolroom Lathes. Sliding gear head construction. Antifriction bearings throughout headstock, endworks and quick change mechanism. Center distances from 30" up in increments of 24".

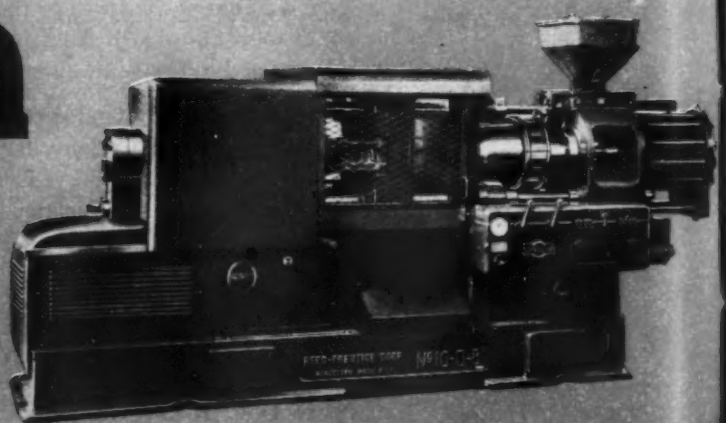


No. 1½G Die Casting Machine, fully hydraulic, suitable for die casting brass, aluminum, magnesium or zinc.

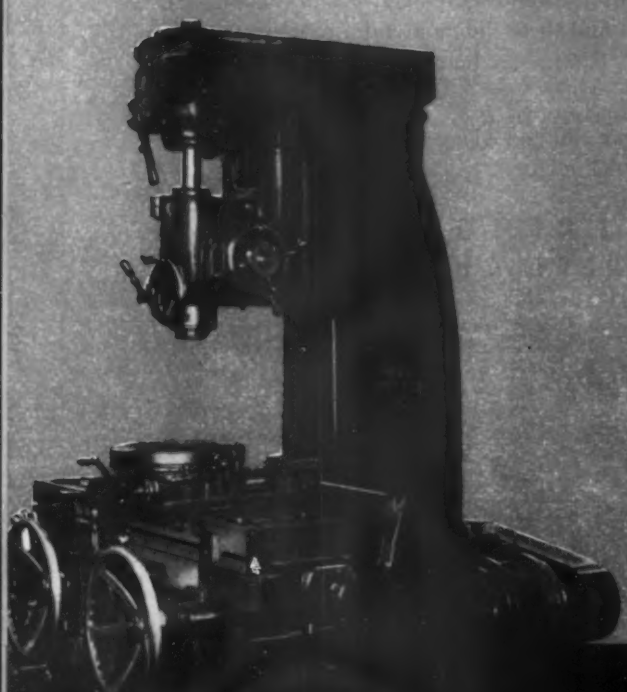
Approx. size of die plates	28" x 29"
Maximum die space	18"
Locking pressure	130 tons
Space between bars	15" x 18"



No. 3VG Miller, vertical type with back geared construction. Longitudinal feed 24". Cross feed 12". Vertical adjustment on knee 18". Table working surface 10¼" x 36". Weight 2850 lbs.



Plastic Injection Molding Machine, 4, 6 or 8 oz. capacity. Handles all thermoplastic powders. Adaptable for use with Saran, also thermosetting. Exceptionally rapid cycle, completely automatic. Newly improved.



No. 5 Vertical Milling Machine. Heavy duty. Longitudinal feed 48". Cross feed 16". Spindle to table 30". Weight 11,500 lbs. Also supplied as Jig Borer with power down feed and measuring devices.

REED-PRENTICE CORP.
MACHINE TOOLS
WORCESTER MASS. U.S.A.

We Believe

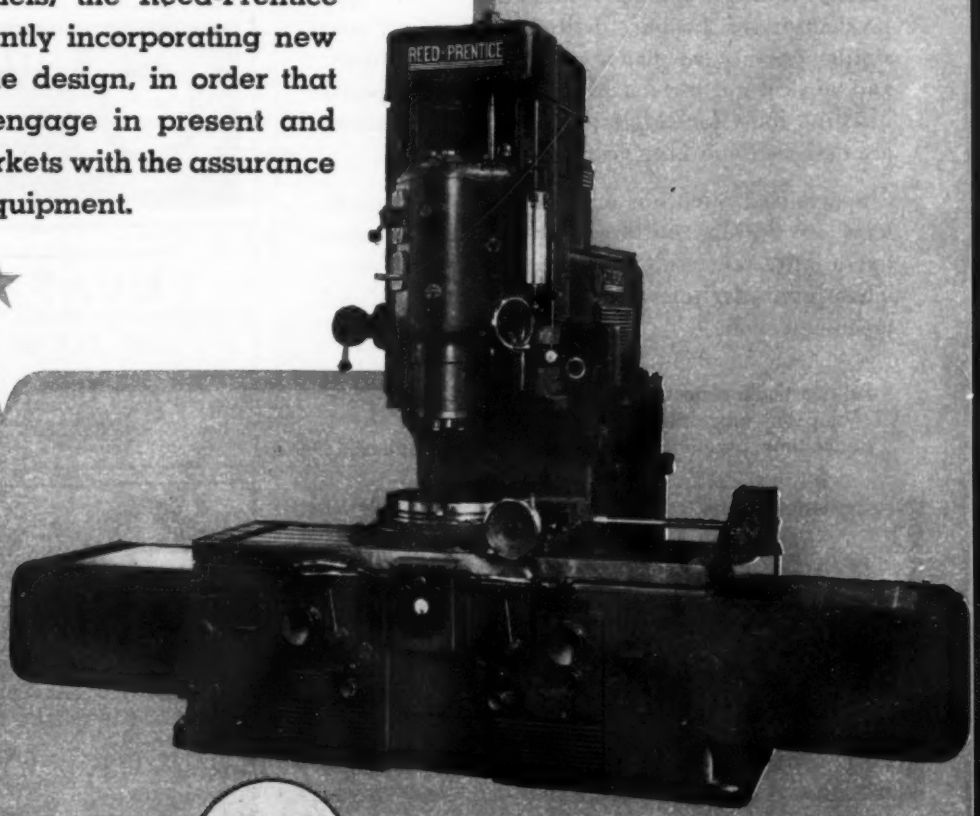
WE, of Reed-Prentice, believe in the future of our country.

WE believe in the American people, who are today creating a future wealth beyond conception through savings and the purchase of War Bonds.

WE believe that the future holds prosperity even surpassing the present.

IN short, we believe that in the Post War period an unequalled market will exist for products that are designed intelligently and manufactured conscientiously.

TO support these beliefs, the Reed-Prentice Corporation is constantly incorporating new concepts into machine design, in order that our customers may engage in present and future competitive markets with the assurance of up-to-the-minute equipment.



No. 4 Vertical Milling Machine. Hydraulically actuated screws provide table and cross slide feeds infinitely variable. Centralized controls. Electronically controlled power down feed at extra cost. Table working surface 24" x 84". Longitudinal travel of table 48". Travel of cross slide 24". Table to spindle nose maximum 24". Weight 20,500 lbs.

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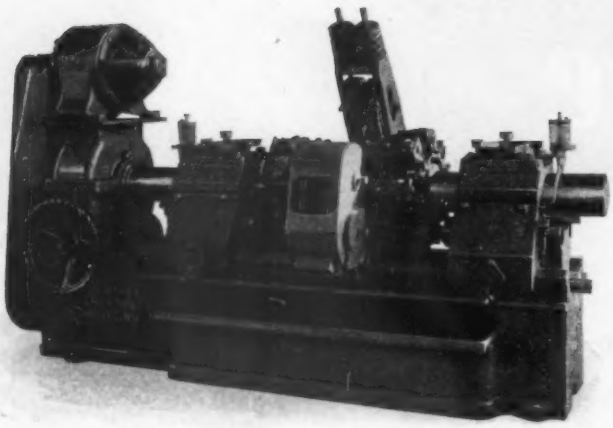
REED-PRENTICE CORP.

MAIN OFFICE
WORCESTER
MASS. U. S. A.



NO. 1A ROTARY MILLING MACHINE WITH CHAIN CLAMPING

Rotary milling machines are for the continuous milling of castings and forgings.

Davis & Thompson Rotary Milling Machines are available in a wide variety of styles and sizes to accommodate a large range of castings and forgings. The size of the work and the production required largely determine the size and type of machine as well as the design of the fixture and the clamping method.

Besides these rotary milling machines, Davis & Thompson build a variety of horizontal and vertical multiple-spindle Rotomatics for the mass production of boring, drilling, threading, and similar operations; planer type milling machines; and vertical milling machines. In addition special machine tools for single and multiple operations are designed and built to order.

Specialized attention to your production problems in boring, milling, drilling, and similar operations may result in applications of Davis & Thompson Machine Tools that will be advantageous to you.

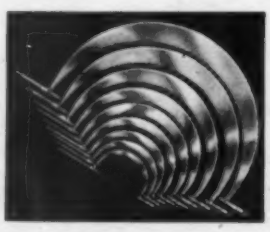
Full particulars on the application of any Davis & Thompson machine to war production or for peace-time planning are available upon request.

D & T

Tubular Micrometers

AND STANDARDS

insure accuracy to the thousandths of an inch on large diameters and bulky, unwieldy parts. Available in 45 different sizes — capacities from 0 to 168 inches.



DAVIS & THOMPSON COMPANY

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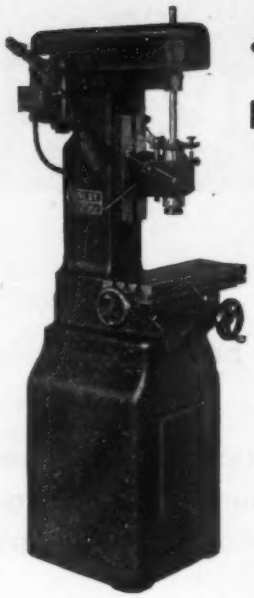
MILWAUKEE 14, WISCONSIN



VERTICAL JIG BORING, MILLING, DRILLING AND REAMING with 8 speeds and micrometer setting

Save YOUR "HEAVIES" FOR THE BIG GAME

It's more productive to let the fast little fellow carry the ball some of the time than to wear out the "big heavy" in all plays . . . both football and industry.

The Linley high speed Jig Boring and Milling machine is a case in point. It saves power, wear and time by taking on a great variety of rush jobs in machine shop and tool room, freeing larger machines for work better suited to their higher capacities.

"A speed for every need"—8 of them, 275 to 4250 r.p.m. and the versatility for quick changeover, simplify operations in precision die work, jig, metal pattern and model making, with maximum tool protection and low cost.

There's a place for one or more Linley's in your shop. Write for instructive bulletin.

SEND FOR DESCRIPTIVE BULLETIN

LINLEY BROTHERS CO.
664 STATE ST. EXTENSION
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LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS-CRANK SHAFTS

Drilling and Tapping Machines

(Automatic and Semi-Automatic)

LELAND GIFFORD CO.
WORCESTER, MASS.

LUCAS "PRECISION"

Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
. OHIO, U. S. A.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
913 Tilden St.
Saginaw, Michigan

KNIGHT · VERSATILE · MILLERS · ACCURATE · RIGID

FOR FURTHER DETAILS
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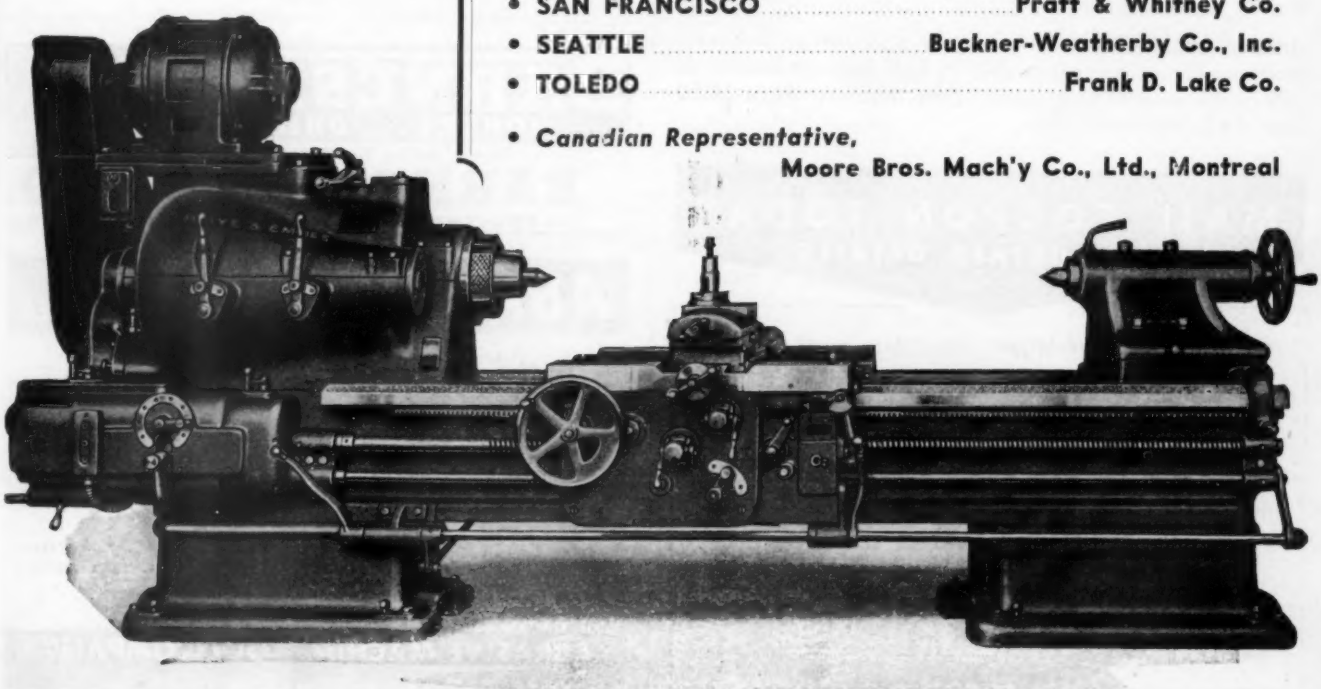
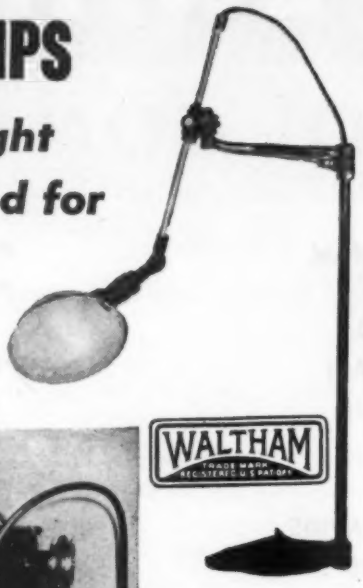


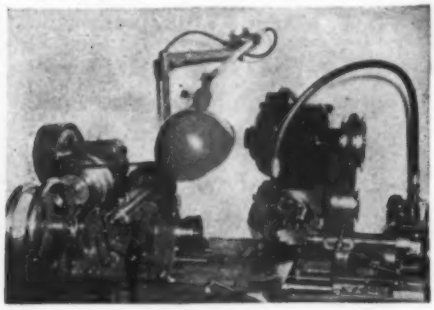
Announcing

NEW LAMPS

to provide light where needed for

WALTHAM THREAD MILLERS





Waltham Lamp applied to Waltham Thread Miller.

● These new lamps — especially designed for use on WALTHAM THREAD MILLERS — are provided with adjustable arms so that reflector can be moved to any part of the machine and light applied exactly as needed.

Ample light is always available wherever it is needed. With the proper light furnished by these new lamps, such operations as cutter setting, changing gears, making adjustments, loading and unloading can be greatly facilitated and greater accuracy assured.

Made especially to fit Waltham Thread Millers, the new Waltham Lamps are applicable to belt-driven machines as well as the modern three-motor drive machine. Price $8.50 each, f.o.b. Waltham, Mass.

MAIL COUPON TODAY
FOR FURTHER DETAILS

WALTHAM MACHINE WORKS, WALTHAM, MASS.

Kindly send full information on the new Waltham Lamp ☐
on the Waltham Thread Miller ☐
(Check information desired)

It is understood this request incurs no obligation.

Name .....

Position .....

Company .....

Address .....

PORTAGE

NO. 4

HORIZONTAL BORING DRILLING & MILLING MACHINE

● Designed and built to meet the need for speed and accuracy demanded of today's production.

WRITE TODAY

for fully illustrated bulletin giving detailed description of the many features of this Horizontal Boring, Drilling and Milling Machine. No obligation.

THE PORTAGE MACHINE CO.
AKRON 11, OHIO

Avey

Sensitive DRILLING MACHINES

CINCINNATI OHIO

BARNESDRIL

HONERS . . . DRILLERS

Write Today for Catalog A

BARNES DRILL CO.

830 CHESTNUT STREET ROCKFORD, ILLINOIS

ABRASIVE INTERNAL GRINDER

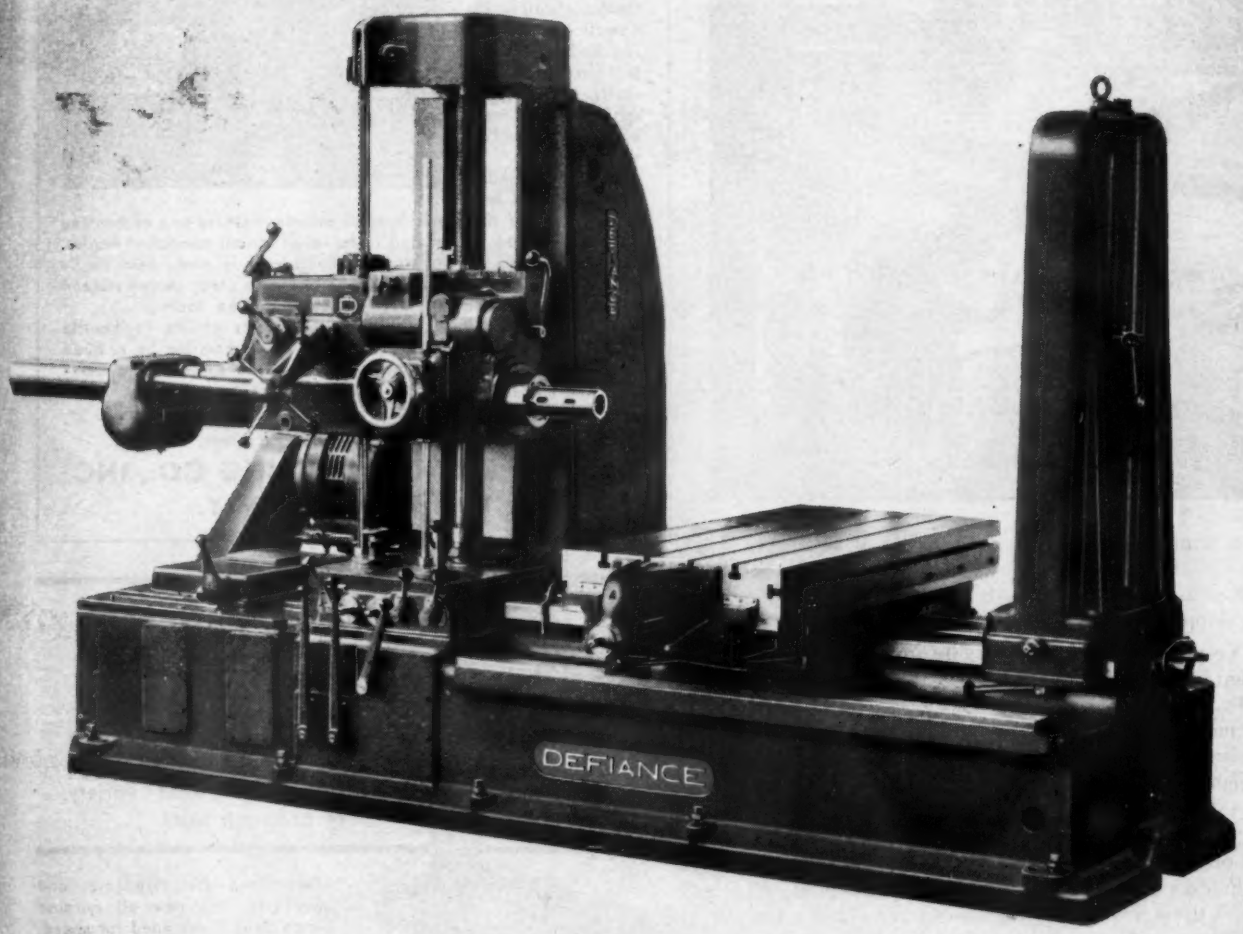
No. IG

Get acquainted with the complete line of Abrasive Grinding Machines.

Write for descriptive literature illustrating the unusual versatility and range of this machine.

ABRASIVE MACHINE TOOL COMPANY
EAST PROVIDENCE, R. I.

DEFIANCE



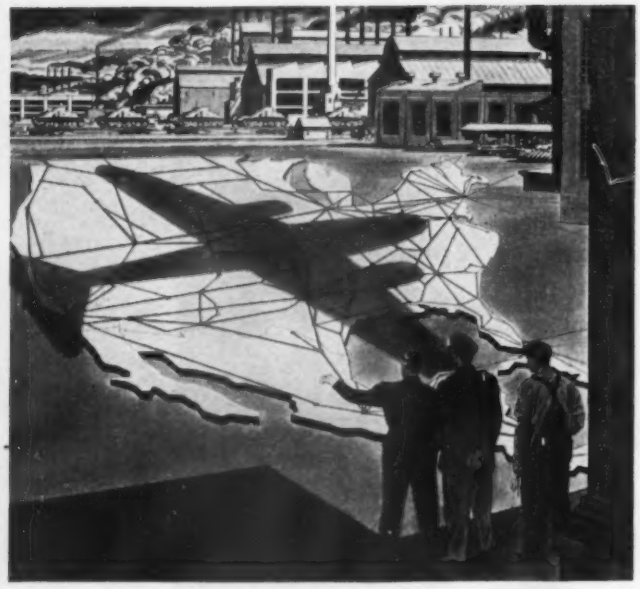
DEFIANCE stands for Accuracy . . . appreciated today more than ever on America's "production front"... where Defiance Mills are helping plants beat tough production schedules with *speed* and *accuracy*.

Defiance Machine Works, Inc., Defiance, Ohio

Makers of Precision Machinery Since 1850

ARMY E NAVY

Get it Fast!
specify
AIR EXPRESS



IF you want your orders shipped *fastest way*, be sure to specify "ship AIR EXPRESS"—because general instructions such as "urgent" and "rush" may be misinterpreted by the shipper.

And it's especially important to specify AIR EXPRESS if your shipment is vital to a war job, because it saves something like 75% of the hours and days consumed over the next fastest means of shipping. This 3-mile-a-minute service is available direct to more than 350 U.S. cities and to scores of foreign countries.

AIR EXPRESS RATES REDUCED

As a result of the great volume of Air Express traffic created by wartime demands and the increased efficiency developed to satisfy these demands... Air Express rates within the United States have been substantially reduced, in some instances as much as 12½%, depending on the weight of the shipment and the distance it moves. Consequently, shippers nationwide are now saving an average of 10½% on air cargo costs.

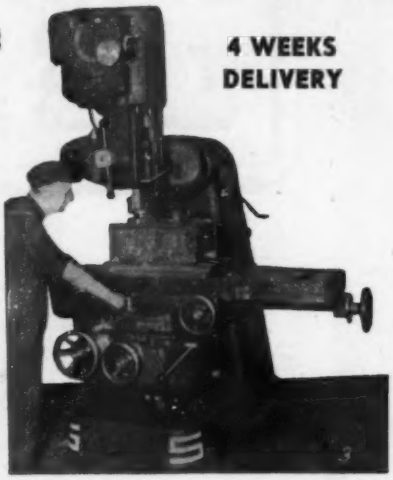
NOTE TO SHIPPERS: *Ship Early*—as soon as shipment is ready—to assure fastest delivery. *Pack Compactly*—to conserve valuable space. **ASK** for our new 1943-44 CALENDAR-BLOTTER. Write Dept. PR-11, Railway Express Agency, 230 Park Avenue, New York 17, N. Y.

AIR EXPRESS
AIR EXPRESS
Gets there FIRST

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

INTRICATE MILLING JOBS handled without the need of fixtures . . .

on the SHIELDS No. 3 VERTICAL UNIVERSAL MILLER

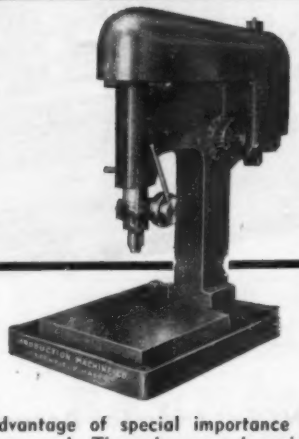


4 WEEKS DELIVERY

This machine furnishes the answer to many problems involved in today's production where intricacies in parts design call for complicated milling and boring operations which ordinarily would require multiple set-ups and special costly fixtures.
The SHIELDS handles such jobs in a single set-up of the work. Special milling fixtures are eliminated because the head is designed to swivel at various compound angles. Universal milling such as dividing head work is made possible by being able to throw head at proper angle to clear cutter instead of the usual method employed by swinging the table.
An exclusive feature of the SHIELDS is its ability to handle angular boring work — an advantage made possible by a head which incorporates motor and power feeds to spindle in a complete unit.

Table working surface — 64" x 16". Sliding head travel — 7".
Write for complete specifications.

SHIELDS MANUFACTURING CO., INC.
Long Island City, N. Y.



The New
TYPE 25 REED BENCH DRILL

Handles a wide variety of precision work . . . .

Streamlined for efficiency and simplicity, this new all purpose Bench Drill is designed for speed, ruggedness and precision performance. Complete enclosure of drive assures maximum safety, an advantage of special importance today where women operators are concerned. The only exposed moving part is the drill chuck.
Rugged strength is achieved by the use of two castings only for base and column. Drive is direct by single belt from motor to spindle through variable speed transmission which provides an instant and infinite speed range from 1500 to 10,000 R.P.M. Spindle is full mounted on precision ball bearings.
Available with any number of spindles, each spindle being driven by individual motor and belt.

CONDENSED SPECIFICATIONS

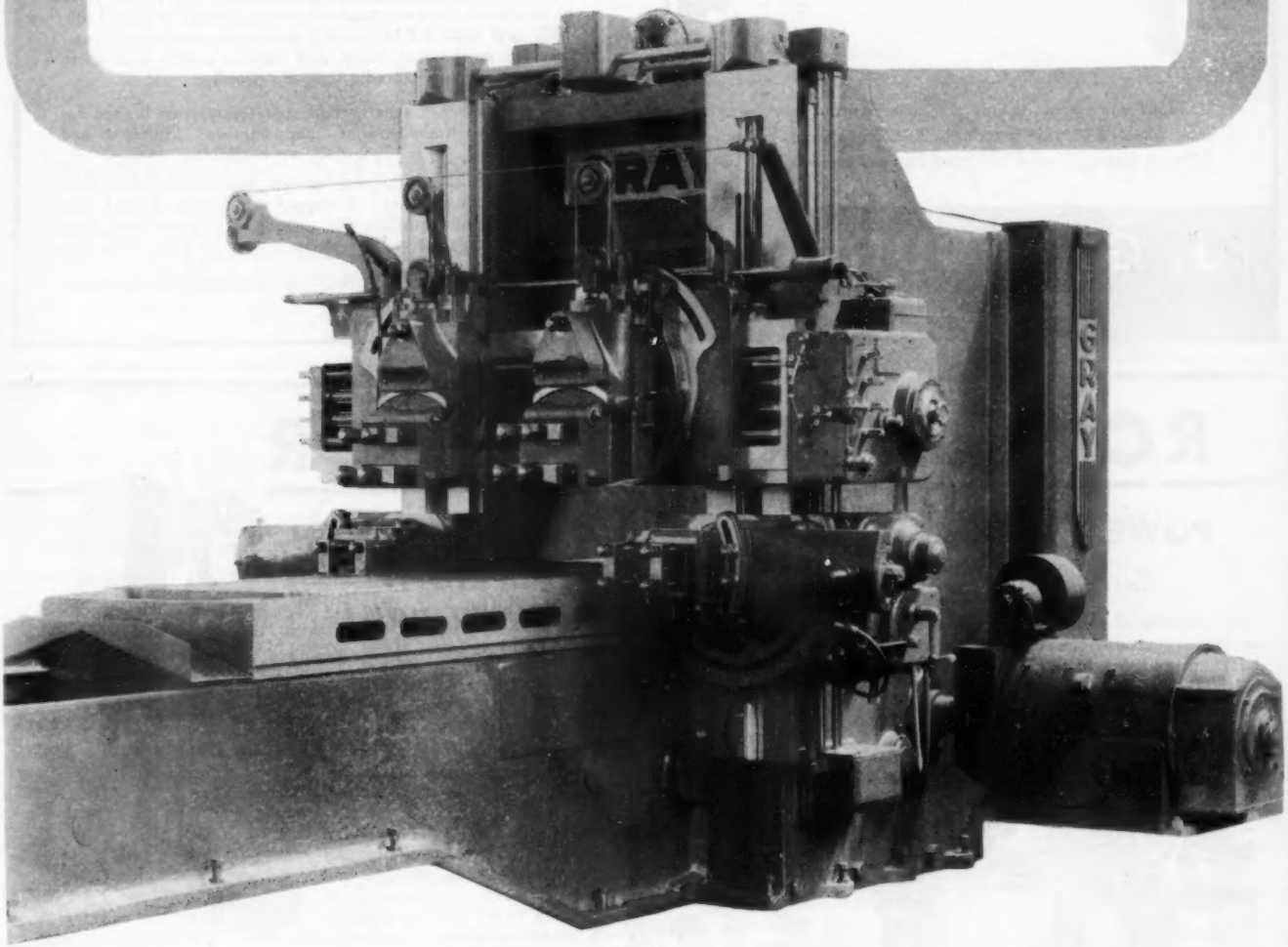
Capacity ¼"
Spindle Travel—3"
Head Adjustment—3"
Center Spindle to Column—7"
Center to Center Spindles—8"

Send for illustrated folder giving full information

PRODUCTION MACHINE CO.
Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

GRAY
DIE-BLOCK PLANERS

● Our war effort has enormously increased the demand for die blocks — hard — tough die blocks. The Gray Die-Block Planer was designed to face, side plane and shank die blocks in the shortest possible time. All heads are swiveling, are equipped with tool lifters and have power feed and rapid traverse. This machine is powered by a 75 h.p. motor.



THE G. A. GRAY COMPANY
Cincinnati Ohio, U.S.A.

THE GRAY LINE — Double Housing and Openside Planers, Switch Planers, Die Block Planers, Double-Housing and Openside Milling Planers, Planer Type Milling Machines, Horizontal Boring Machines.

"Blount" MOTOR HEADSTOCK LATHE

Offering increased production, ease of operation, quietness and safety . . .

Modern in every detail the Blount unit type Motor Headstock Lathe can be depended on for superior performance.

Motor headstock is of anti-friction bearing enclosed construction and aligned with the bed. Motor is a ½ H.P. ball-bearing 4-speed type, 220V, 3 phase, 60 cycle. Bed is designed for a 12" swing.

Controller, of enclosed dust-proof type, is provided with magnetic starter having overload and low voltage protection. Speed control handle conveniently located on front of headstock, makes standard spindle speeds of 600, 1200, 1800 and 3600 R.P.M. quickly and easily available. Combination mechanical break and cut-out switch and automatic disengaging spindle lock are provided.

Bed is of heavy construction, generously cross-braced for maximum stiffness, rigidity and balance. Standard bed lengths of 4', 5', 6', 7' and 8' are available.

Tailstock is of open-side design, lever-clamped to bed. Stock is self-ejecting. A rugged quick action tool rest provides ample surface for all jobs. Cabinet type legs provide convenient storage space.

Standard equipment includes: 8" combination rear faceplate and hand wheel, 6" inside faceplate, 3" screw chuck, ¾" spur center, ¾" cup center, 7" and 10" hand tool rests and 2½"x4" angle rest.

Complete detailed specifications available on request—Ask for Bulletin D-17.

J. G. BLOUNT CO.

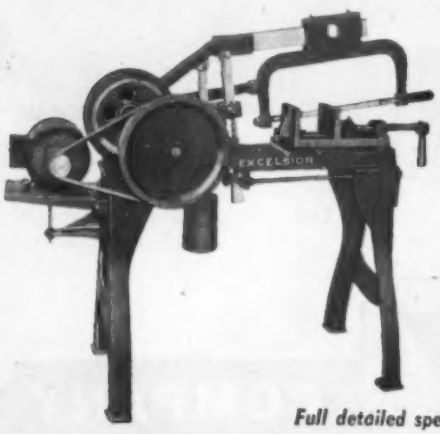
Everett, Mass., U. S. A.

ROYERSFORD-EXCELSIOR

POWER HACK SAW NO. M2A

Saves Time — Saves Blades

The economy of this machine — in operating time and cost — is in large measure due to the provision made to minimize blade buckling and breakage. These advantages are attained by automatically lifting blade on return stroke and placing it in contact with work on cutting stroke. Gravity feed and automatic stopping of saw on backward stroke contribute also to protect against blade breakage.

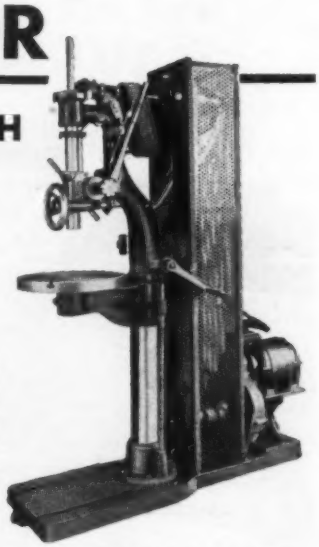


Drive from motor is through milled gears to assure more power and faster cutting.

Cutting capacity 6"x6".

IMPROVED 21-INCH UPRIGHT POWER DRILL

Fast and Accurate, Simple and Sturdy



Every modern convenience for fast precision drilling and easy handling is provided in this Royersford-Excelsior motor driven back-geared drill. It combines simplicity and operating speed with strength and rigidity and can be depended on to drill up to its 1½" in capacity with utmost accuracy.

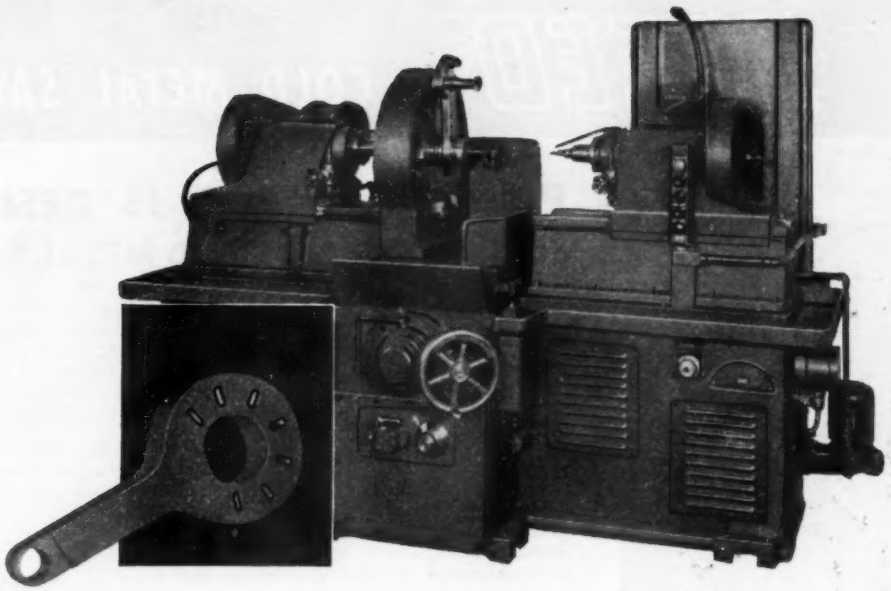
Gears are machine cut — bearings large and powerful — change from a plain drill to a back-geared drill can be made instantly by merely sliding the gears — spindle is provided with ball thrust bearings top and bottom, counter balanced, and has automatic stop with quick return — table has quick action screw for raising and lowering.

Diameter of table 18"; spindle traverse 9"; spindle to table 29".

Full detailed specifications on these machines available promptly on request.

ROYERSFORD FOUNDRY & MACHINE COMPANY, Inc.

ROYERSFORD, PENNA.



45545

New Double-End Hydraulic Spline Milling Machine by Snyder

This machine is designed to mill seven slots in each side of an aircraft master rod, illustrated in the tryout piece, inset. The part is loaded and clamped manually on a seven-position indexing fixture which is mounted on a reciprocating table moving between solid stops

The two milling heads advance rapidly against hydraulically operated feed stop screws and feed into the work by steps which are adjustable from .005″ to .060″ per infeed stroke. Meantime, the hydraulically operated table maintains its automatically reciprocating transverse travel cycle, thus establishing the length of the slots. This transverse movement is adjustable for feed travel of one-half inch to ten inches per minute.

When full cutting depth is reached, cutters dwell in the work during several reciprocations to produce a clean finish in the slots. Each slot measures 1⅛″ x 7/16″ x 7/16″. Production rate is approximately three rods an hour.

For set-up and tryout purposes, infeed can be controlled manually. Both manual and automatic infeed are indicated, per stroke, on the dial on the front of the machine beside the handwheel. The machine base is welded steel construction and houses the bulk of the reciprocating and feed mechanism. Hydraulic equipment and coolant container are housed separately on the rear of the machine.

Although developed especially for the aircraft industry, this machine embodies well-established operating principles and includes standard Snyder units of well-proved efficiency, all of which lend themselves readily to application in post-war production.

★

POST-WAR PLANNING

The advantages of using special machines to achieve high production at low unit cost will be just as important in post-war operations as they are today. The time to consider such machines is *now*, while product designs are still flexible and may be adapted, if necessary, to secure the greatest possible advantages in machine design. In this important phase of post-war planning, the experience and advice of Snyder engineers may prove most valuable to you. It is freely at your service, without obligation. We invite your inquiries.

SNYDER TOOL & ENGINEERING COMPANY

3400 East Lafayette — Detroit 7, Michigan

SNYDER

DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION *AT LOW UNIT COST*

SPEED IN COLD METAL SAWING

The PORTER - McLEOD IS DESIGNED FOR HIGH SPEED COLD METAL SAWING

Straight, clean cuts on a truly high production basis are assured by the 8" Porter-McLeod. It is a compact, sturdy, amply powered unit designed for handling general or production work with utmost operating convenience and control. Economical quantities of bars or shapes can be "nested" and held rigidly during cutting by means of supports provided on sides and bottom combined with clamping pressure at top.

In the Porter-McLeod, the blade is supported for accurate cutting and for protection against damage. Adjustment is also provided for changes in blade thickness. Feed of blade is upward to stock with provision made to prevent weaving and buckling. Standard feeds up to 3" per minute are available. Protection against blade breakage due to hard spots in stock is provided by a friction feed disc.

This machine will handle either 8" round or 7½" square stock or the equivalent in "nested" work.

Investigate the high production possibilities of this machine by sending for descriptive Bulletin.

MACHINE TOOL COMPANY

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASSACHUSETTS, U.S.A.

CRITERION *Diamond* TOOLS

For **STEADY PRODUCTION**

Dependable diamond tools are vital in present production schedules. Every day more users are turning to Criterion Diamond Tools for the kind of service which they must have. Quality of diamonds used plus a unique method of setting assures extreme rigidity and extra tool life. Special tools made to order following blueprints or specifications. , selected thread grinding tools. Request free literature.

MACHINE WORKS
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CRANK SHAPERS
sizes 12" to 32" stroke
THE SMITH & MILLS CO. Cincinnati, Ohio

ROCKFORD MACHINE TOOL CO.
Hy-Draulic
Shapers . . Planers . . Slotters . . Shaper-Planers
— ROCKFORD, ILLINOIS, U. S. A. —

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Consistent Quality
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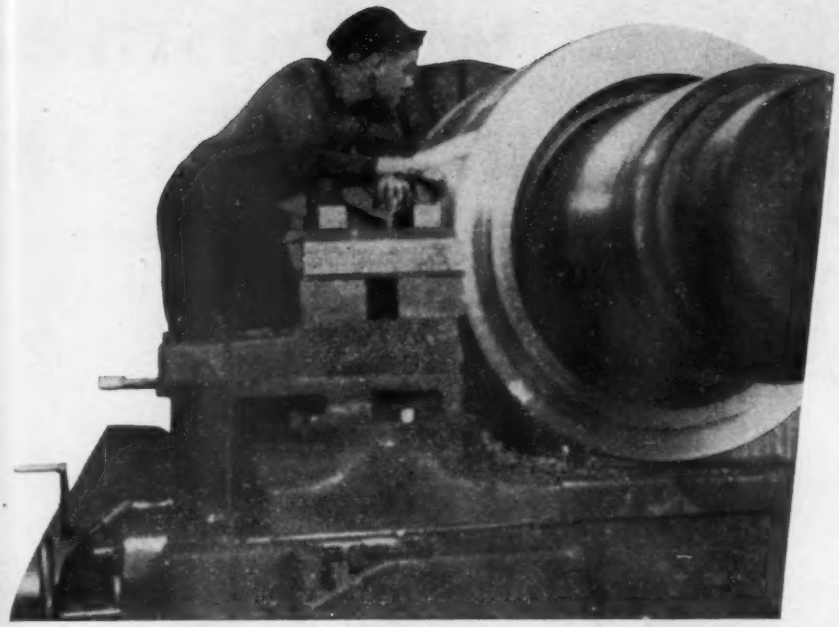
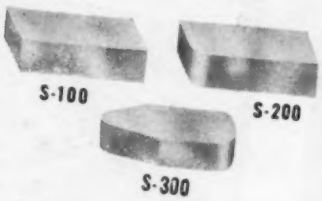


STYLE 11

MILLING CUTTER



S-100

S-200

S-300

KENNAMETAL'S GREATER HARDNESS

Assures *Superior Performance*

Efficient machining is the conversion of electric power into chips or cuttings in the least possible time. When the material being machined is steel, a tool of extremely hard composition must be employed to maintain this efficiency at a high level.

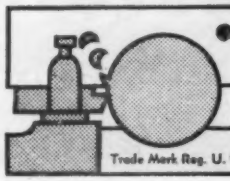
KENNAMETAL steel-cutting carbide tools are preferred to other carbides because their high hardness combined with greater strength enables them to more efficiently turn, face, bore and mill steels up to 550 Brinell.

Grade	Rockwell C	Rockwell A	Strength Transverse Rupture Lbs./Sq. In.
KM	77.6	90.8	305,000
KH	78.6	91.3	275,000
K3H	79.6	91.8	260,000
K4H	80.6	92.3	225,000

KENNAMETAL'S exceedingly high Rockwell rating gives it the ability to "hold size" on long cuts and permits such accurate machining that roughing and finishing can often be accomplished in one operation. Tool wear is greatly reduced, resulting in more finished pieces per tool regrind.

Because of this greater hardness, KENNAMETAL carbide steel-cutting tools will operate at higher speeds and feeds and efficiently machine weld spots, hard scaly surfaces and sandy steel castings with minimum tool consumption.

Improved deliveries are now being made on standard and typical tools, standard tips, lathe centers and grinder centers. Write for your KENNAMETAL catalog and select the tools you need from the wide variety of available types and sizes.



KENNAMETAL Inc.

103 Lloyd Ave., Lahobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

KENNAMETAL THE All American CARBIDE

NOTES to a war-time machinist

Blind Holes

Make sure blind holes are drilled deep enough so the tap does not strike the bottom, or else breakage will result. Allow enough room for the accumulation of chips ahead of the tap. A full flow of lubrication will help remove the chips.

Size of Tapped Hole

Taps exactly the same size will cut different size holes if the rake of the cutting edges are different. In resharpening a dull tap, particular care must be given to the rake of the cutting edges to insure uniform sized holes. Grind the dull tap to conform closely to the shape of a new one

Remember—

A tap out of alignment with the hole will cause a bell-mouthed hole; and set up cramping strains very likely to break the tap.

A tap cutting slightly small, will cut from one thousandth to three thousandths of an inch larger (depending upon the size of the tap), when reground a little more hooking on the cutting edges.

Bakelike, hard rubber, and fibre wear taps down quickly. High Speed steel taps last longer, especially those treated for tapping plastics.

When threading soft materials (such as aluminum), taps should be advanced very carefully to avoid torn threads and bell-mouthed holes.

Select the tap for the job; use plenty of good lubrication; and keep the cutting edges of the tap sharp. Dull taps always cut poor threads; turn hard; and break long before they are worn out.

Winter Brothers

COMPANY Wrentham, Massachusetts, U.S.A.

KEEP VERNIER TOOLS AT THE PRODUCTION FRONT

—*Safeguard* these Tools for the production demands of your Country — it may take months to replace them these days.

To get the most from your Vernier Tools and to protect them against injury, observe the following simple suggestions:

HANDLE Vernier Tools, particularly large tools, with extreme care.

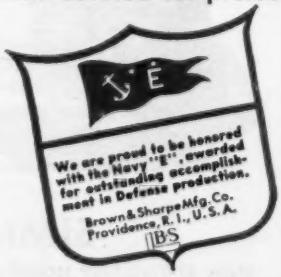
Before moving the sliding member of a Vernier, **WIPE THE BAR** thoroughly. Dirt carried by the slide can damage graduations and interfere with the operation of the tool.

WHENEVER REPLACING sliding member on the bar, be sure that the gibs are not reversed from their original positions.

GUARD against the effects of heat on the accuracy of Vernier Tools. Hold in the hands as little as possible and do not place them near steam pipes, in sunshine or by other heat sources.

DO NOT TOSS Vernier Tools loosely into a drawer or drop them, as sudden shock can cause unsuspected damage and misalignment. Keep them covered for protection when not in use.

Remember that every Vernier kept in useful service helps to make a **new** one available where it may be needed urgently for our united war effort.


We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
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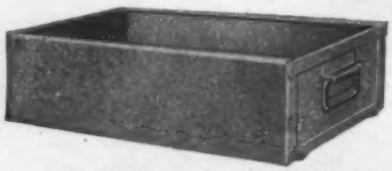
BROWN & SHARPE TOOLS

IMMEDIATE SHIPMENT

STEEL BOXES

FOR YOUR PRODUCTION NEEDS



STYLE 300 — STACKING BOX

Just right for your small parts. Light in weight, easy to handle. Equipped with drop handles each end. Runners save wear on bottom of box and act as positive stacking lock.

•

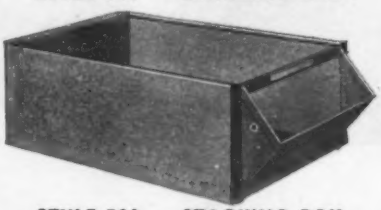
No. 301 6" x 9" x 3½" 20 ga....$ .55 Ea.
No. 302 8" x 12" x 4" 20 ga....$ .60 Ea.
No. 303 9" x 13½" x 4½" 19 ga....$ .75 Ea.

STYLE 600 — STACKING BOX

An ideal all-purpose shop box, Sturdy all-weld construction. Heavy skids act as positive stacking lock and re-inforce box at point of maximum wear.

•

No. 601 10" x 16" x 6" 18 ga.....$ .95 Ea.
No. 602 12" x 18" x 8" 16 ga.....$1.25 Ea.



STYLE 500 — STACKING BOX

Open front makes contents easily accessible when boxes are stacked. Will stack with Style 600 boxes.

•

No. 501 10" x 16" x 6" 18 ga.....$1.15 Ea.
No. 502 12" x 18" x 8" 16 ga.....$1.50 Ea.

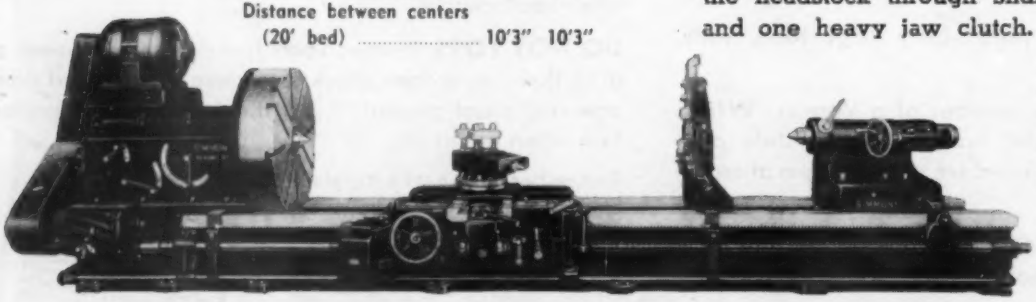
AMERICAN METAL WORKS, INC., 1509 Germantown Ave., PHILADELPHIA, PA.

48" and 54" HEAVY DUTY LATHE

Simmons Heavy Duty Engine Lathe is of exceptionally rugged construction. A long bearing on the bed ways assures adequate rigidity and strength of the headstock. Head is fully enclosed and all bearings and gears are constantly lubricated by positive pressure oil pumps. Nine speed changes are provided to the main spindle of the headstock through sliding spur tooth gears and one heavy jaw clutch. Boring bar tailstock designed for boring long holes of large diameter (max. diameter 8"). *Write TODAY for Descriptive Bulletins Giving Complete Details.*

SPECIFICATIONS

	48"	54"
Swing over bed	50"	55½"
Swing over carriage	36"	42"
Distance between centers (20' bed)	10'3"	10'3"



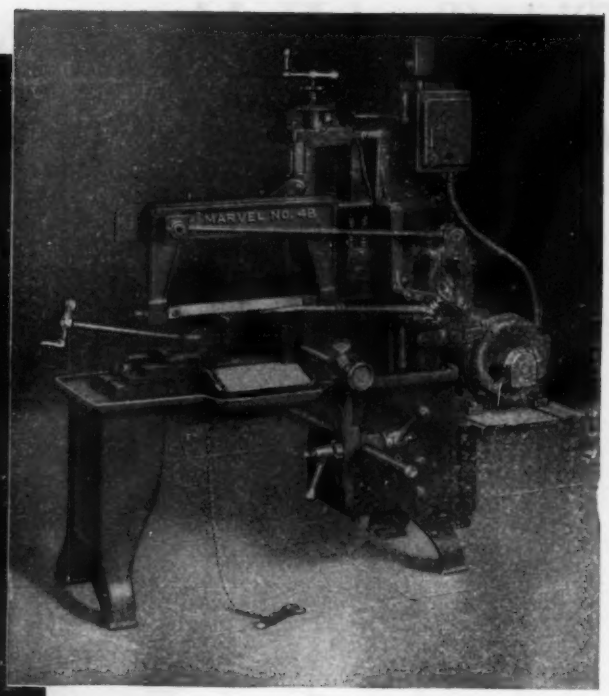
SIMMONS MACHINE TOOL CORPORATION

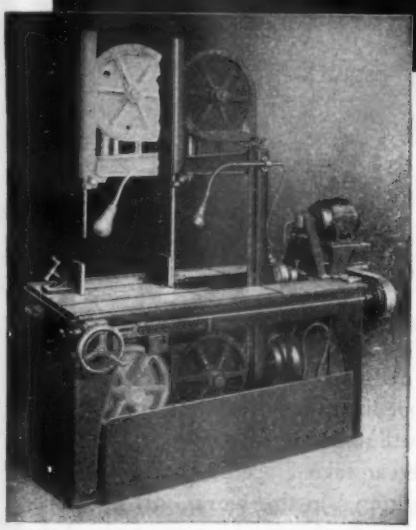
Main Office: 1759 NORTH BROADWAY, ALBANY 1, N. Y. *New York Office:* 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

How fast is a "FAST METAL CUTTING SAW"?





Double Exposure — Showing limits of feed travel and position of main column for square cutting.

Front View—Showing column set at angle of 45° to right of vertical for miter cutting.

The now universal use of the word "Fast" in describing metal-cutting band saws has led to confusion among saw buyers as to what constitutes fast or high speed metal sawing. Hence this explanation.

You will find that the MARVEL No. 4B cuts at least 2½ times FASTER and at a blade cost of not more than one-third that of band saw machines that are advertised as "fast" and "economical". Before buying any metal cutting band saw, consult our local MARVEL Metal-cutting Engineer. As builders of BOTH hack saws and band saws, we alone can give you an unbiased recommendation as to the best, the "fastest" and the "most economical" saw for your type of work. We will recommend our MARVEL Band Saw ONLY when a reciprocating hack saw will not do your job better. The #4B (illustrated above) is a low-priced machine. MARVEL Heavy Duty All-Bearing Hack Saws are still MUCH FASTER.

On the other hand, the No. 8 MARVEL Band saw is the most versatile and universal metal-cutting saw built. It will cut off or will make re-entrant cuts in anything from ⅛" rod to large structural shapes, bars, castings or billets up to 18" x 18" in cross section. Because of its wide capacity range and unique design; its large T-slotted table with quickly removable vise jaws; its horizontal 18" carriage movement that feeds the entire blade-carrying column straight forward through the work at any angle from 45 degrees right to 45 degrees left of vertical. It is ideally suited to tool room, stock room, maintenance, fabricating, and production work, when the wide range of work encountered requires the exclusive features of this universal machine that are not available in any hack saw or in any other band saw. Only the MARVEL No. 8 has the capacity range for cutting-off EVERYTHING in combination with availability for making re-entrant cuts, notching, coping, mitre cutting and roughing-out work to size and shape.

DON'T CONFUSE THE MARVEL No. 8 WITH ANY OTHER BAND SAWS. THERE IS NO COMPARISON. ONLY THE MARVEL No. 8 IS UNIVERSAL!

FOR FASTEST AND MOST ECONOMICAL WORK IN CUTTING OFF BAR STOCK USE A HACK SAW. FOR UNIVERSAL WORK IN AN EXTREME RANGE OF WORK SIZES USE A MARVEL No. 8 METAL BAND SAW.

Whenever the relative urgency for War production requires it, reasonably prompt deliveries can be made.

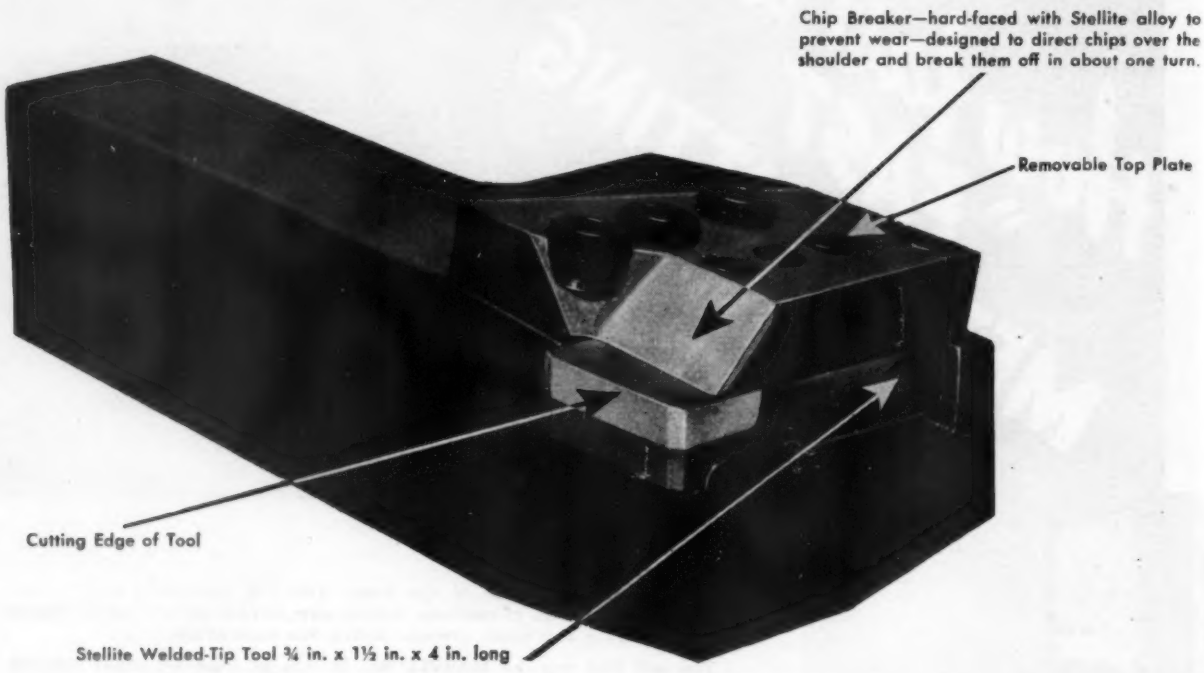
MARVEL SAWS

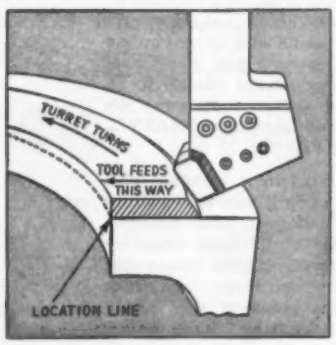
ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 W. BLOOMINGDALE AVE. CHICAGO 39, U. S. A

This Tool Holder *uses small Stellite tools on big jobs and cuts tool cost and grinding time*


Chip Breaker—hard-faced with Stellite alloy to prevent wear—designed to direct chips over the shoulder and break them off in about one turn.
Removable Top Plate
Cutting Edge of Tool
Stellite Welded-Tip Tool ¾ in. x 1½ in. x 4 in. long



The tool holder shown above holds a Stellite-tipped tool for rough machining the bottom face of the cast armor steel tank turret as shown in the simplified cross-section sketch at the left. Surface speed is 65 ft. per min.; feed is 0.040 to 0.060 in. per rev.; and the depth of the cut varies from ⅜ in. to more than 1 in. Holders for both right- and left-hand heads of the machine use identical tool bits.

The tool holder shown here has made possible important savings in overall costs of heavy machining operations on combat tank turrets of cast armor steel. This is because the holder permits use of small Stellite-tipped tools, with resultant savings in original tool cost, in tool-metal consumption, and in grinding time. Rake angles are incorporated in the tool holder, and only a simple relief angle needs to be ground on the tool itself. Holders for both right- and left-hand heads of the machine use identical tool bits. Adjustment of the tool to compensate for wear is in the line of wear, so tool life is considerably prolonged.

Full Cutting-Edge Support

Tool breakage is reduced to a minimum because this holder supports the tool directly under the cutting edge. This support permits full utilization of the heavy feeds and deep cuts that Stellite tools can take. Since the tool is wider than the deepest cut encountered in this work, only one corner of the cutting edge of the tool is working at a time. A dull tool, therefore, can be turned over and used in the opposite head without being reground.

Detail Drawings Available

Haynes Stellite Company does not make or sell this holder. But if you believe that Stellite tools and holders of this type would be useful in your work, further information —and detail drawings of the holder—can be made available without cost.

BUY UNITED STATES WAR BONDS AND STAMPS

STELLITE
Reg U S Pat Off.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York 17, N.Y. UCC Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles—San Francisco—Tulsa

• HIGH-PRODUCTION METAL-CUTTING TOOLS •

"Stellite" is a registered trade-mark of Haynes Stellite Company.

Support to "Shangri-La"

Official U.S. Navy Photos

Maintaining the "eyes of the fleet" calls for constant conditioning of planes, engines and parts. In manufacture as well as maintenance, time and work savings *plus* precision results in

FINISHING DE-BURRING POLISHING are assured by

WELDON ROBERTS **Brightboy**

"THE SOFT RUBBER BINDER CUSHIONS THE ABRASIVE"

Improvements in production are accomplished by this versatile abrasive because of its *soft rubber binder* — a war-proved achievement in the field of metal finishing.

The advantages of Brightboy have been demonstrated over and over in the manufacture and maintenance of planes, in the shipbuilding, engine, tank and parts production which make up the materials and munitions of war.

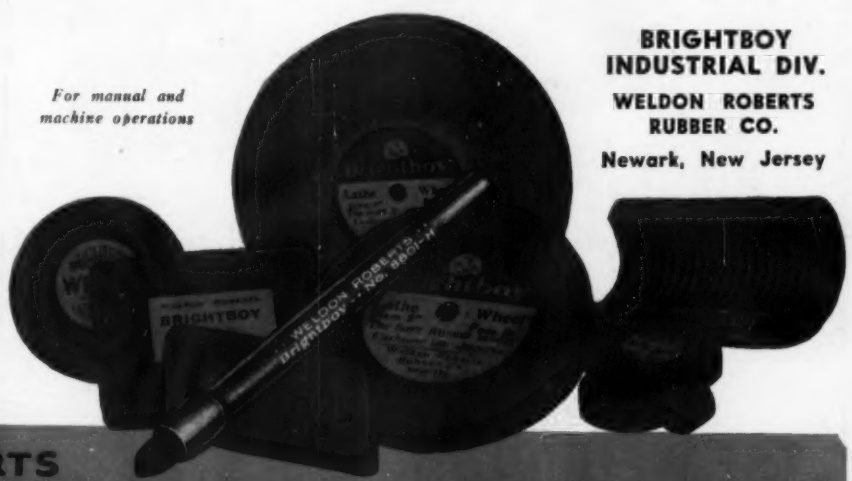
Brightboy can solve finishing problems, speed up production for you. Ask your distributor for "Methods and Applications" data, catalogs and prices. Our field representatives are at your service.

Outstanding Work Advantages of Brightboy

for All-In-One FINISHING, DE-BURRING, POLISHING

- Bridges the gap between a grind and a buff.
- Does not load, gum or fill.
- Works metals with minimum dimensional loss.
- Requires no special preparation. Gives a precision finish that frequently serves as a final polish.
- Made in wheels, blocks, sticks, rods — for manual and machine operations.

For manual and machine operations



BRIGHTBOY INDUSTRIAL DIV.

WELDON ROBERTS RUBBER CO.

Newark, New Jersey

WELDON ROBERTS

Brightboy

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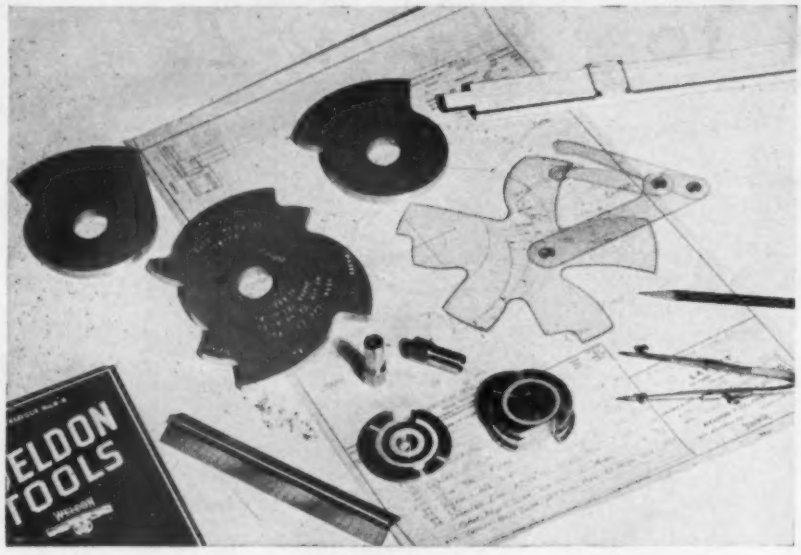
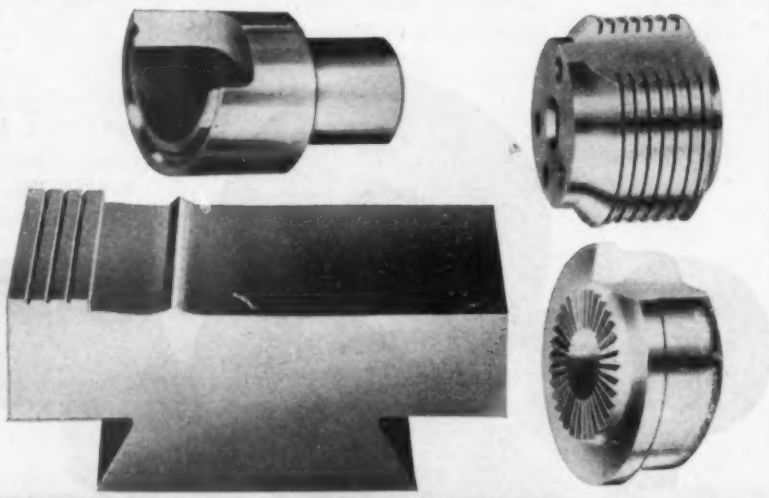


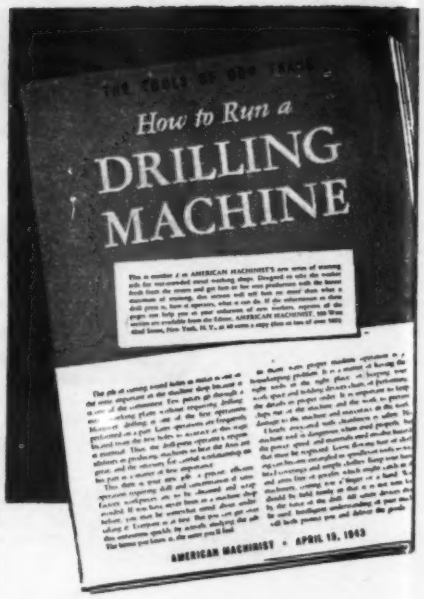
WELDON
CAMS and TOOLS
for SCREW MACHINES

● The WELDON TOOL COMPANY throughout its twenty-five years has manufactured a complete line of screw machine cutting tools. The great increase in volume of automatic screw machine production evidenced a demand and provided the opportunity for offering screw machine tool customers a complete cam and tool engineering service. The wide and varied experience represented by this highly specialized Cam Department is at the disposal of any producer of screw machine products to the end that careful engineering in combination with accuracy of manufacture results in tooling of the highest quality and of lasting satisfaction.



THE WELDON TOOL CO. *Cleveland, Ohio*

3000 WOODHILL ROAD



To HELP YOU PUT NEW MACHINE OPERATORS on IMPORTANT PRODUCTION JOBS . . . with minimum time for training

● A 16-page, illustrated, practical training course on elementary shop practice as applied to drilling. Designed to help production executives take men or women workers fresh from the streets and make efficient machine operators out of them in shortest possible time.

Appearing originally in *American Machinist* as No. 2 in the series of special training sections on "Tools of Our Trade", the demand for this feature in reprint form clearly indicates the value placed upon the helpful information it contains.

Send for the number of copies you need while they are available. Price 10¢ each; less in lots of over 500. Use coupon below.

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Please send me ..... copies of "How to Run a Drilling Machine".
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MAKING THE WORLD'S FINEST STANDARDS

1899 • 1943

● SHOP WHERE HJALMER ELLSTROM DEVELOPED THE ORIGINAL GAGE BLOCK.

● PLANT WHERE CHROMIUM PLATED GAGE BLOCKS ORIGINATED (the only major improvement since their origination).

A Family Tradition

The manufacture of gage blocks has become a family tradition with the Ellstrom family. Elmer Ellstrom, the founder of the Dearborn Gage Company, worked as an apprentice to his father, Hjalmer Ellstrom when the latter worked on the development of the gage block. This apprenticeship was served from 1899 to 1904 at which time his father worked in the tool room of the great Swedish Arsenal in Eskilstuna Fagersta where the finest grade of steel known is made. With this steel at his disposal, the elder Ellstrom contributed to the development of the steel analysis which permits the stability required in gage blocks.

Together with this development a process of seasoning steel was discovered as well as an instrument for checking dimensions in degrees of accuracy. So effective were these discoveries that to this day they have no equal in reliability and precision.

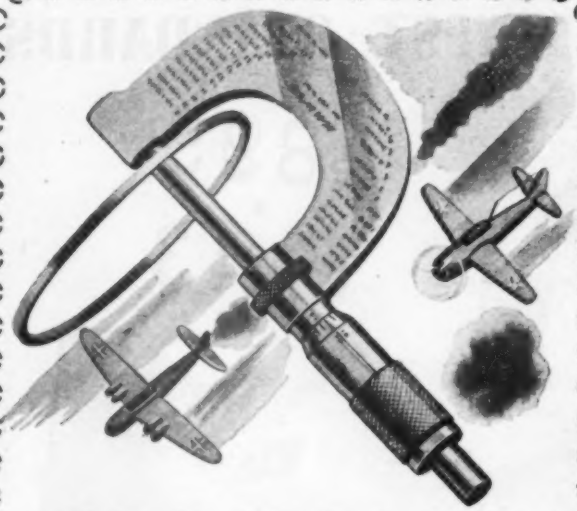
After having spent his early years in the very birthplace of precision measurement, Elmer Ellstrom desired more experience in methods used in the steel-working industry and in 1904 came to the United States where he found employment with large manufacturers in this country, such as Westinghouse, Mesta Machine Company, Joseph Bullard Company and the Martin Bomber Company.

With this wide experience as a background, Elmer Ellstrom began his own company in 1936 and with the assistance of his three sons, Ralph, Olof and Elmer, he has built the Dearborn Gage Company into a recognized leader in its field.

Yes, the manufacture of gage blocks is truly "a family tradition" with the Ellstrom family and it is undoubtedly the reason why Dearborn Chromium Plated Gage Blocks are known for their superiority throughout the world.

DEARBORN GAGE COMPANY 22038 BEECH STREET DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks



PRECISION
where it counts!

The margin between victory and disaster to the fighter pilot depends upon that all important factor — precision. Likewise today's demands on marking equipment are for precision — plus speed. With a background of continuous pioneering and development since the beginning of this century, Noblewest equipment is today foremost in the field of high-speed precision metal marking. Our new catalog supplement No. 43 describes Noblewest Marking Machines and Methods that meet practically all requirements of industry. Write for it today.

NOBLE & WESTBROOK MFG. CO.
Marking specialists since 1904
EAST HARTFORD, CONN.

MODEL 183
Designed for marking P & W Aircraft Engine piston rings where distortion of thickness must be held to within .001 of an inch. Will mark all sizes of rings up to 6" and can be retooled for marking other flat parts of uniform thickness at rapid production speeds.

MARK IT BEST WITH NOBLEWEST — NOBLEWEST IMPROVED MARKING DEVICES

. . . Like *All* Plomb Tools

Professional mechanics find the Plomb box wrench exactly right, for three important reasons —

1. **It works better because it is accurate, well-balanced, built for efficiency.**
2. **It is safer because it will not slip.**
3. **It lasts longer because it is practically unbreakable.**

You'll find these things true of all Plomb tools — from wrenches to cold chisels — and you'll find the ones you need for your war job at the Plomb dealer near you. Call on him for your stock tools — *Plomb Tool Company, Los Angeles 11, California, U.S.A.*

PLOMB

THIS TRIMMER SAW IS PUTTING WINGS ON "BOX CARS"

Because it leaves wood with remarkably smooth, square ends, this Disston saw is speeding the production of the newest wonders of war-spurred aviation—the huge 8-motored planes that have proved they can carry 120,000 pounds of *freight*.

Long renowned for running true and cutting straight, the Disston 4-S Smooth Trimmer Saw isn't a new tool. In helping mass production of the giant wooden, water-based flying box cars, it has simply found a new and thrilling job to do in the war effort.

Made of specially heat-treated Disston Steel, highly tempered and hollow ground for longer life between sharpenings, this efficient saw reflects the craftsmanship responsible for the extra quality of all types of Disston wood and metal cutting saws, files, hack saw blades, tool bits and machine knives. Cooperation on tool problems and information about Disston products are yours for writing Henry Disston & Sons, Inc., 920 Tacony, Philadelphia 35, Pa., U. S. A.

While Disston engineers are creating new tools with which to do old jobs better, the standard Disston tools are ever finding new ways of usefulness.

DISSTON

Conserve Man-Minutes **and help win the war**

Is this YOUR Cleaning Problem?

REMOVING SCALE AFTER HEAT TREATING

If you want an easier, more effective way of removing scale from steel parts after heat treating, the experience of one plant making sub-machine gun parts will interest you.

By immersing parts for short period in recommended solution of Oakite Compound No. 32, this concern now gets more thorough, more uniform results. Sand blasting has been eliminated in many instances. Those parts still requiring it are handled faster. Output is 200% greater! Tell us your scale removal problem . . . we can help!

OAKITE PRODUCTS, Inc., 24 Thames St., NEW YORK 6, N. Y.

Technical Service Representatives Conveniently Located in All Principal Cities of the United States and Canada

OAKITE CLEANING

Now YOU

can get this

DOUBLE HEADER RATCHET WRENCH

The FAVORITE Reversible Ratchet Wrench . . . the ONLY wrench that handles two sizes of nuts with one head . . . is available right now for prompt deliveries.

It's the TIME-SAVING wrench. No lifting off at the quarter turn. No slipping in action. No lost motion. Perfect balance, simplified construction, permit continuous speed without fatigue. Fits over long studs, into tight places.

Three sizes, each accommodating five different double heads. Each strongly built for heavy duty. Ask your mill supply house.

GREENE, TWEED & CO.

Bronx Blvd. at 238th Street New York 66, New York

FAVORITE* Reversible Ratchet Wrench

*REG. U.S. PAT. OFF.

DON'T WAIT FOR TURRET LATHES

Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing.

● This new modern TOOL-POST TURRET (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held.

6 Days Delivery

● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (below, right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL-FEED LEVER. Jefferson Turrets are real production tools—substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market.

Pat Pending

4-Tool Tool-Post Turret

Three Weeks' Delivery

The Jefferson Bull-Dog Precision Milling Machine. Obtainable Power or Hand Feed.

5-Tool Tail-Stock Turret

Pat Pending

● ALSO—*Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.*

JEFFERSON MACHINE TOOL CO.

SWEENEY CUTTER & TOOLING IS [illegible]

Write for Bulletin

STEVENS MILLING MACHINE VISES

5 in., 6 in. and 7 in. sizes

All parts Interchangeable

JOHN B. STEVENS INC.

474 Canal St., New York 13, N.Y.

LUERS

Patented Cutting Off Tool Holders
Patented Cutting Off Blades

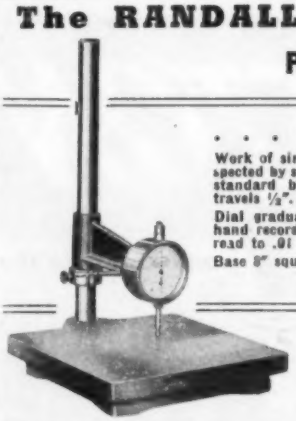
ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

Manufactured By

J. Milton Luers — 12 Pine St. — Mt. Clemens, Mich.

Produced under License Issued by John Milton Luers Patents Inc.

The RANDALL & STICKNEY Platform Gauge



. . . . takes work up to 7 inches

Work of similar size can be quickly and easily inspected by setting gauge head at desired height with standard block or plug. Spindle on gauge head travels ½".

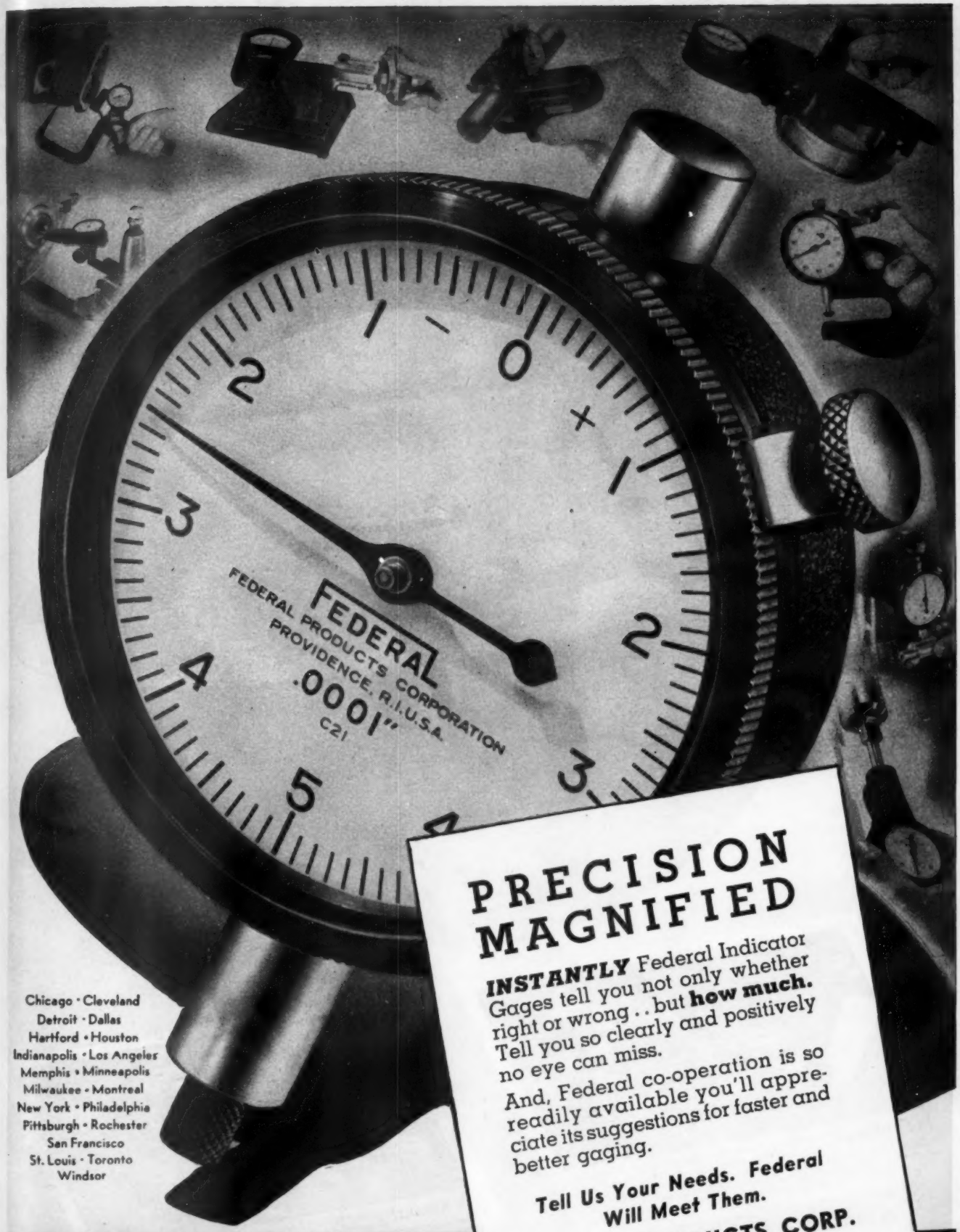
Dial graduated 0 to 50 in. thousandths; second-hand records 10ths of inches. Can be furnished to read to .01 mm.

Base 8" square; height 13"; weight 18½ lbs.

Investigate Now!!

RANDALL & STICKNEY

Waltham, Mass.



PRECISION MAGNIFIED

INSTANTLY Federal Indicator Gages tell you not only whether right or wrong . . but **how much.** Tell you so clearly and positively no eye can miss.

And, Federal co-operation is so readily available you'll appreciate its suggestions for faster and better gaging.

Tell Us Your Needs. Federal Will Meet Them.

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★ FEDERAL ★

PRECISION MEASURING INSTRUMENTS

Stepping Up . . . and Keeping Up t
STEEL CUTTING P

In England! American carbides—rushed to England when war cut off German supplies—have helped English industry drastically reduce war production time. Regular shipments of carbides—from Carboloy Company—started early in 1939.

In Russia! Underground shops, such as this, typify the grim determination of Russia in turning out war production to rout German hordes. American carbides—supplied since shortly after Russia joined the Allies—have helped Russian industry increase output.

Acme

IN SOUTH AMERICA!
IN AFRICA!
IN AUSTRALIA!
IN MEXICO!
IN INDIA!
IN CHINA!
AND THROUGHOUT THE UNITED STATES

Up the NG PRODUCTION of the United Nations

WITH the outbreak of war in 1939, the Allied Nations—abruptly cut off from Germany as a principal source of supply for carbides—diverted the full flood of their carbide demands to the United States.

Fortunately, American industry had established—as far back as 1928—its own independent sources of supply. These American suppliers were ready to meet the emergency with a background of 10 years' experience in the development, manufacture and application of this urgently needed material. They had the skill, the equipment, and a generous margin of reserve capacity.

To the hard pressed Allied Nations—struggling to offset the tremendous output of a German war production long since tooled with carbide *by official decree*—went tons of American carbides in steadily increasing quantities. Foresight and preparedness enabled American carbide manufacturers to fill this urgent need and at the same time meet the pyramiding demands of domestic industries.

Today, you will find carbides a factor of vital importance in stepping up and keeping up the production of not only the United States but also such countries as England, Russia, Australia, Canada, China, India, Mexico and many others among the United Nations.

The full extent to which carbides are being used in the cause of victory is difficult to visualize. Carboloy Company production alone, for example, is at an annual rate 45 times greater than that of any pre-war year. Monthly production of carbides—formerly measured in pounds—can today be expressed in tons—many tons per month! Yet the average carbide tool contains but a fraction of an ounce of carbide at the cutting edge—and a single tool during its usable life machines hundreds of parts for the implements of war. Particularly important is the use of carbides for cutting steel—a major field of use for Carboloy tools. (More than 60% of the Carboloy Cemented Carbide produced today for machining purposes is for cutting steel.)

A high order of performance—so high as to have been once considered incredible—is now commonly expected, and obtained, with carbides. Such things as increases in output of 3 to 1, lengthened tool life of 10 to 1, finish cuts that eliminate arduous grinding, machining of former "non-machineable" alloys, reductions of 25%, 50%, 75% in machining costs—results such as these are every-day occurrences in war production today.

This widespread use of carbides in war, indicates a new era of production economy when normal commerce returns. Manufacturers who have converted to carbides to meet the present emergency will then have at their immediate disposal an economic weapon of unusual advantage in seeking world markets.

CARBOLOY
TRADEMARK

TITANIUM, TANTALUM, TUNGSTEN CARBIDES

CARBOLOY COMPANY, INC., DETROIT, MICH.

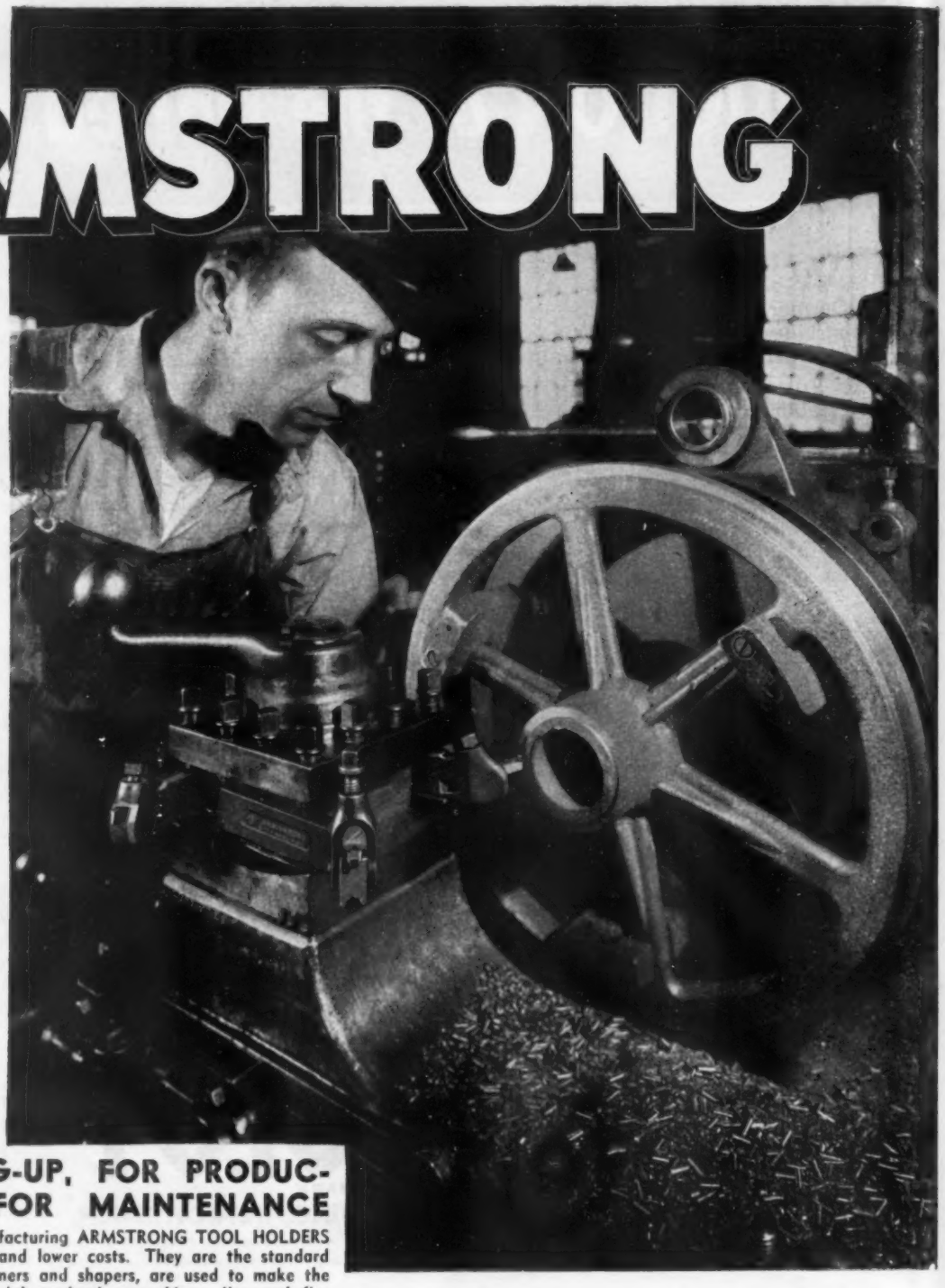
Birmingham, Ala. • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle • Thomaston, Conn.

Authorized Distributors: Canadian General Electric Co., Ltd., Toronto. *Foreign Sales:* International General Electric Co., Schenectady, N. Y.

In Canada! In swiftly stepping up production Canada has extensively used carbides. Closely cooperating—Carboloy Company has not only supplied carbides but also helped furnish equipment and technique for rapid step-up in Canadian carbide production.

THIS WIDESPREAD USE OF CARBIDES IN WAR, INDICATES A NEW ERA OF PRODUCTION ECONOMY WHEN NORMAL COMMERCE RETURNS.

ARMSTRONG



FOR TOOLING-UP, FOR PRODUCTION AND FOR MAINTENANCE

. . . at every stage of manufacturing ARMSTRONG TOOL HOLDERS save time, increase output and lower costs. They are the standard cutting tools on lathes, planers and shapers, are used to make the dies and to build the special production machines, jigs and fixtures required for large scale production. And, it is ARMSTRONG TOOL HOLDERS that keep the production equipment operating for they are used to repair, overhaul and for maintaining it.

Today ARMSTRONG TOOL HOLDERS are also being widely used on production lathes, turret lathes, hand screw machines and often on the larger automatics. As production tools their greater strength permits higher speeds and feeds, because they will stand up to any cut the machine tool can pull. They are more economical too, because they cost less originally, last indefinitely and "Save; All Forging, 70% Grinding and 90% High Speed Steel."

When you have a tooling problem, if there is a metal to be machined, it is always good policy to first check over your ARMSTRONG Catalog for you will often find exactly the tool you used in an ARMSTRONG TOOL HOLDER which is stocked by your local Mill Supply House.

ARMSTRONG BROS. TOOL CO.

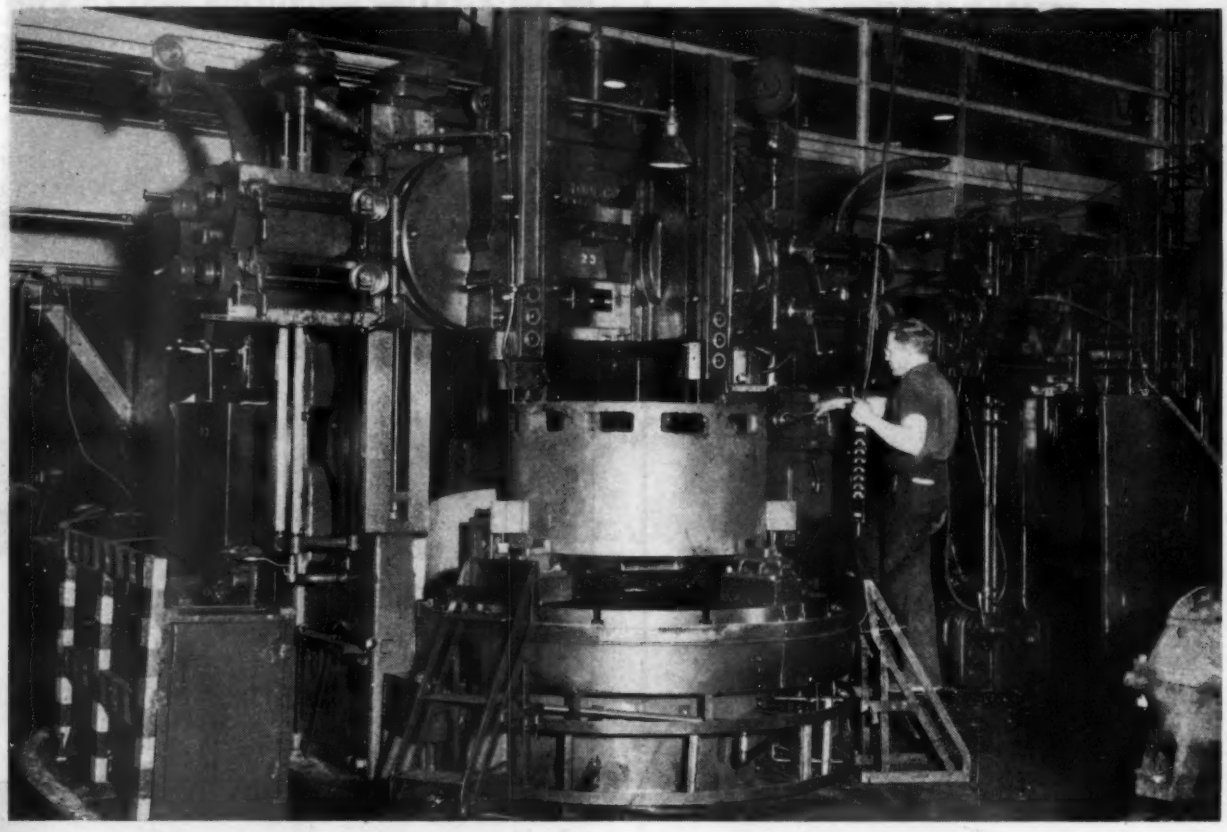
"The Tool Holder People"

315 N. FRANCISCO AVE. CHICAGO, ILL.

Eastern Warehouse and Sales:
199 Lafayette St., New York

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms



RIGIDITY
that insures
DEPENDABLE ACCURACY

★

KING
VERTICAL BORING & TURNING MACHINE

● It takes in-built rigidity and rugged construction to meet the close tolerances required on heavy duty boring and turning work today.

For example on the job shown with the cross rail close to the top of the side columns the King Vertical Boring Mill has ample power and rigidity to maintain desired tolerances on this work.

If your work calls for turning, boring-facing or a combination of these and similar operations you can depend on King rigidity to meet all demands of accuracy and production.

King Builds Vertical Boring and Turning Machines in single column types from 30" to 42" — double column types up to 10 feet.

The KING MACHINE TOOL Company
BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY
CINCINNATI, OHIO

TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

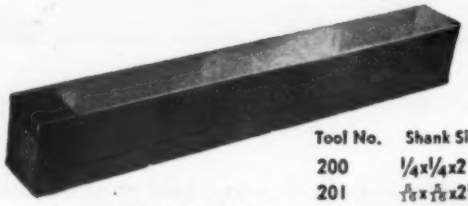
New Low Prices—Increase Production—Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

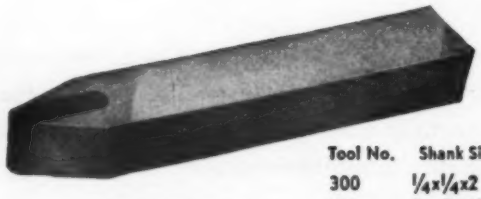
SERIES 100

Tool No. RH	LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	7/16x7/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	7/16x7/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	7/16x7/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

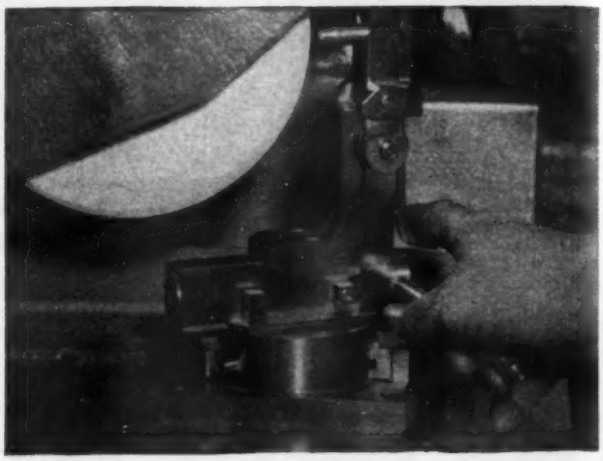
WE CARRY SILICON CARBIDE EMERY WHEELS FOR GRINDING TUNGSTEN CARBIDE TOOL BITS

Send for our latest circulars

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTER STREET NEW YORK, N. Y.

A RADII & ANGLE DRESSER

OF PRECISION AND VERSATILITY



An instrument of precision and versatility . . . Operation is simple requiring no high degree of skill for accuracy . . . Any one of the following can be produced with one setting:

One angle
Two angles
Concave radii up to 6"
Convex radii up to 4½"
Two angles and radius.
Many other diversified forms to meet requirements.

Wheel size capacity—14" dia.; angular travel 3"; for use on universal surface and cylindrical grinders.

Full details available on request.

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J. & S. TOOL CO 477 MAIN ST EAST ORANGE N. J.
PRECISION DRESSING TOOLS

HOLMAN

BETTER, FASTER HOLE FINISHING

HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
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Remelt and Cast Your Lead Hammers with the Field Mould and Ladle

Save time and money—keep lead hammers in good condition at all times—easy to use—fast. Made in 7 sizes for hammers from 1 to 11 lbs. Write for details.
Also, Lead Hammers, sizes 1 to 15 lbs. always in stock.

JOHNSON TOOL CO., INC.
East Providence Rhode Island, U.S.A.

ACROMARK

numbering, stamping and marking machines and accessories are extensively used where fast, accurate permanent work is a prerequisite.

THE ACROMARK CO. ELIZABETH NEW JERSEY

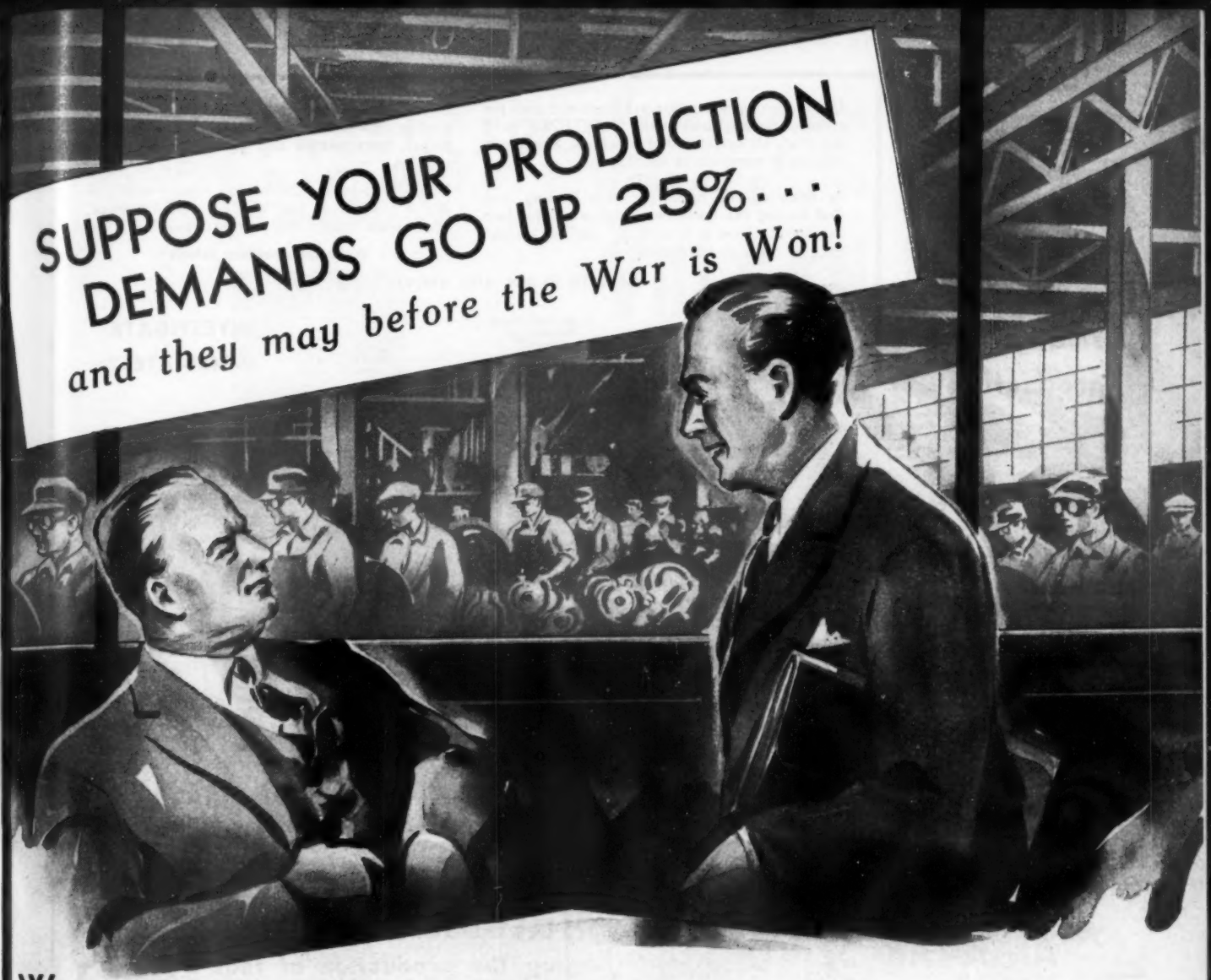
Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
- ALL AROUND DEPENDABILITY

Bulletins available: General Purpose Die Heads, Insert Chaser Die Head, Threading Machines.

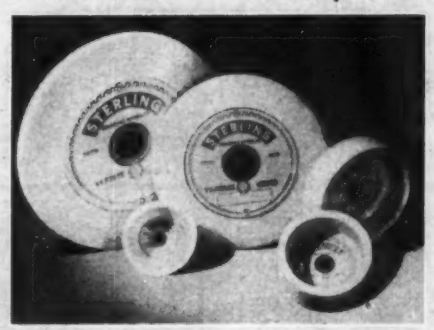
See our Advt. on page 190, Dec. 10, '42 American Machinist

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Los Angeles: A. C. Behringer, 324 N. San Pedro St., San Francisco: Guy Reynolds, 464 Vernon St., Oakland, Canada: Arthur Jackson Mech. Tool Co., Toronto and Montreal



WE are on our way to certain victory, but until it is achieved, there is still a big industrial job to be done! Demands of wartime production still seem greater than present manufacturing facilities can produce. There isn't time to build more factories and mills; better results must be obtained from present facilities. That's where Sterling Grinding Wheels enter the picture.

New types of these "Wheels of Industry", built to the demands of each of your grinding jobs, will result in faster production . . . greater accuracy . . . better results! There is a Sterling Wheel with a special combination of bond, grain, structure, size and shape to solve your troublesome problems . . . help you keep your production in tune with wartime demands.



Sterling Tool Room Grinding Wheels are recommended for precision work . . use them with confidence!

Finding the correct Sterling Grinding Wheel for your jobs is a simple matter of asking for the services of a Sterling engineer. Skilled by consultation on hundreds of wartime grinding problems, he is well worth the short time necessary for talking over your difficult grinding assignments. Not only will he recommend any new wheels you may need, but he will also suggest new uses for your old ones . . . utilize them elsewhere in your plant.

Have you received literature on the latest Sterling developments? Ask today for folders on our Sterfast and Sterback Grinding Wheels, recently produced to relieve the strain of meeting difficult production schedules . . they may be just what your need in your plant.

• STERLING ABRASIVES •

THE
STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

Use the "HARTFORD" Quick-Acting MILLING VISE to speed up small arms production

Quick opening and return are combined with tremendous binding force in the "HARTFORD" Milling Vise, all operations of which are handled by two easily manipulated levers.

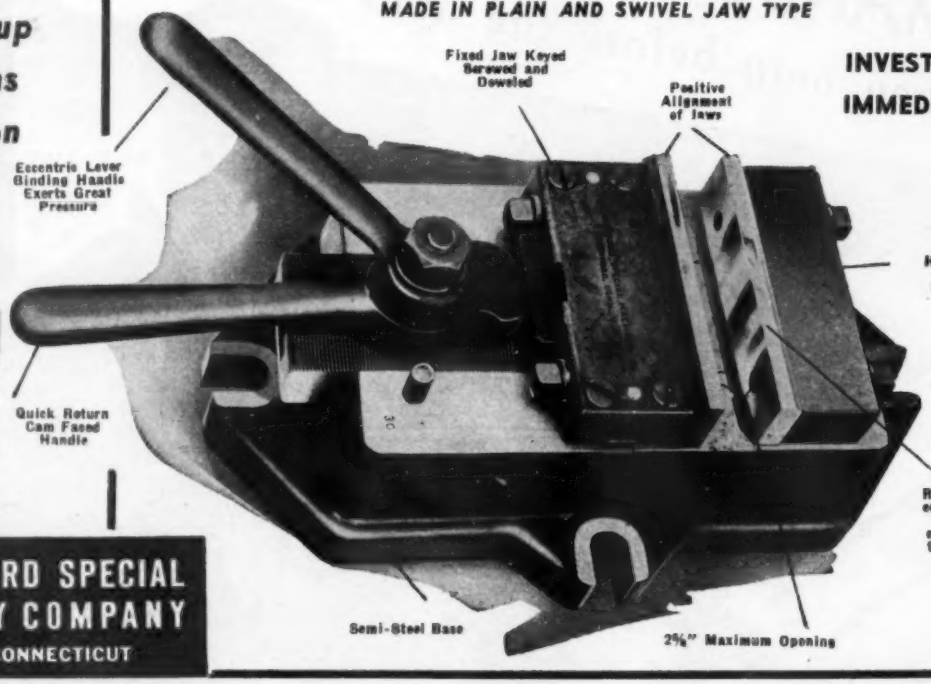
By releasing the upper eccentric binding lever and moving the lower cam lever a quarter turn, the movable jaw is opened 7/8" for quick clearance of chips or release of work.

Unique design and rugged construction insure positive jaw alignment. Movable jaw is drop forged, heat treated and ground on all fitting surfaces.

Made in Plain and Swivel Jaw types. Width of jaw 5"; depth of jaw 1 3/16". Jaw openings: 2 5/8" (plain type); 2 1/4" (swivel type).

Write for complete details

MADE IN PLAIN AND SWIVEL JAW TYPE


Fixed Jaw Keyed Serewed and Doweled
Positive Alignment of Jaws
Eccentric Lever Binding Handle Exerts Great Pressure
Movable Jaw Drop Forged Heat Treated and Ground on all Fitting Surfaces
Quick Return Cam Faced Handle
Removable Hardened and Ground Jaws. Interchangeable with those of No. 2B and S. Vise
Semi-Steel Base
2 5/8" Maximum Opening

Jaw width—5"
Jaw depth—1 3/16"
Max. opening (Plain Jaw)
Jaws in place—2 5/8"
Jaws removed—3 1/2"
Max. opening (Swivel Jaw)
Jaws in place—2 1/4"
Weight 40 ℔
Length—13"
Width—8"
Height—5"

INVESTIGATE IMMEDIATELY

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD, CONNECTICUT

SAVE TIME ON INTRICATE
★ *ANGULAR SET-UPS* ★

MULTI-SWIVEL VISE

Fully universal . . . three swivels simplify the setting of compound angles.

Parts interchangeable . . can be used as a plain flanged vise, a swivel vise or a multi-swivel vise.

The Platen greatly increases the capacity of the unit. Vise and Platen are interchangeable.

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MASTER TOOL CO.
161 HIGH STREET • BOSTON MASS.

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

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THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
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JAMAICA, NEW YORK
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PHOENIX
ADJUSTABLE LIMIT
SNAP GAGE

A Gage with Locking Cams which will stay set

Good Delivery

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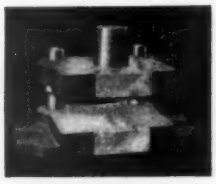
PHOENIX GAGE CO., Phoenix, N.Y.

PRODUCTO DIE SETS

ARE TOPS ON THE PRODUCTION FRONT



TOPS is the Word for Producto Service on Die Sets and Die Makers' Accessories from Bridgeport, Detroit, Cleveland and Los Angeles.

Enlarged facilities at the above assembly plants assure prompt shipment today on catalog items.

Special Die Sets can be shipped without delay from Bridgeport or Detroit.

THE PRODUCTO MACHINE COMPANY
3017 MEDBURY, DETROIT, MICH.
998 HOUSATONIC AVE., BRIDGEPORT, CONN.

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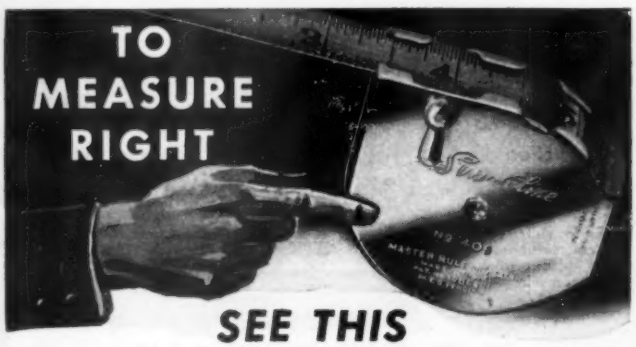


SEE THIS

The name "Master" on a steel tape or on a wood rule identifies a measuring tool built for precision work. The Master line includes rules with precision lock, rules which may be used as inside measure, outside caliper measure and height gauge. The Master "Streamline" steel tape is graduated on both sides and all edges.

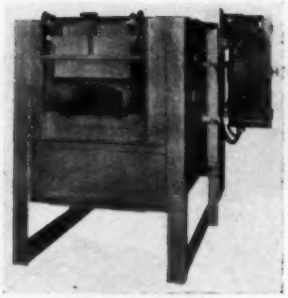
READ THIS

Master's new pocket-sized how-to-measure book is called "Rules for Measurement", and is packed with pictures and helpful suggestions for proper selection and use of rules. It covers the kind of rule to use, how to use it correctly, how to take care of it — in short, *how to get the most from your rule.* Write for your free copy.

Master Rule Mfg. Co., Inc.
815 E. 138th St., N. Y. C., Dept. P-9
Branch: 541 S. Spring St., Los Angeles, Calif.
Please send me, without charge, "Rules for Measurement".
Name_____
Address_____
City_____ State_____

MASTER
WOOD AND TAPE RULES

Versatility is a Feature of This VULCAN



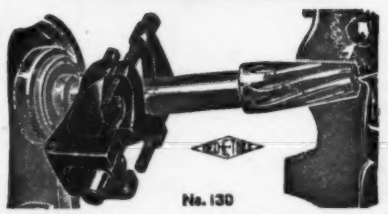
Continuous Pusher Type FURNACE

Electrically heated, with controlled atmosphere. Designed for handling, simultaneously, three sizes of material requiring same temperature treatment. Adaptable to special operations such as glass sealing of spark plug porcelains or other work necessitating uniform heating, close control of furnace temperature and variable rates of production. Can be supplied with muffles for firing with gas or oil. Temperature range, 500°F. to 1750°F.

Although custom-built, VULCAN Furnaces cost no more than those of standard design, and can usually be installed promptly. Write for Bulletin "V".

VULCAN CORPORATION
1737 CHERRY STREET, PHILADELPHIA, PA.

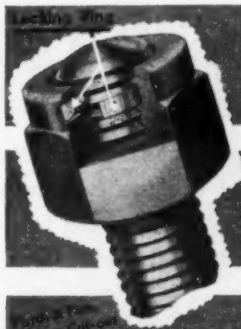
NO LOST MOTION



when indexing work held between centers on a universal milling machine.

Sliding ball and socket universal joint eliminates binding or cramping and assures accurate spacing.

The
READY TOOL CO.
Ironistan and R. R. Aves.
Bridgeport, Conn.



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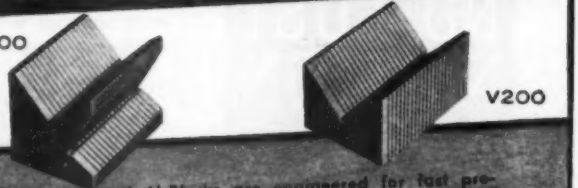

These Magnetic-V-Blocks are engineered for fast precision production. Holds your work firmly without slipping. Helps increase operation efficiency. Soon pays big dividends on your investment. Write today for descriptive circular.

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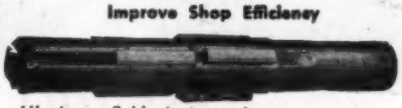
Equip your shop with these economy tools for holding work while being machined. Hardened tool steel—precision ground.



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JACOBS CHUCKS

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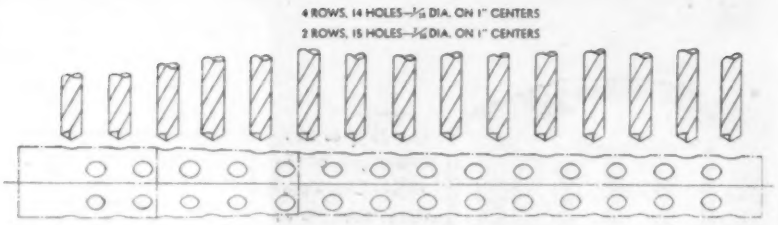
15 SPINDLE HOEFER UNIT

Drills Seamless Steel Tubing BARREL JACKET

A fifteen-spindle head, guide bushing plate and side indexing fixture with six station indexing work holder, drilling eighty-eight 7/16-inch holes, 1-inch centers in air cooled jacket of machine gun.

As production increases so do savings with Hoefer Multiple Spindle Heads. These units will more than repay your investment in the quality of work produced and in uninterrupted service that contributes so greatly to lower cost operation. Our many years of experience in manufacturing Multiple Spindle Heads qualifies us to take over your problem and solve it for you. No matter what your job is we can furnish the head to meet your production need. Add a Hoefer Head to your present machine and turn it into High-Production Money-Saving Equipment.



Job requires 4 rows, 14 holes—7/16" diameter on 1" Centers and 2 rows, 15 holes, 7/16" diameter on 1" Centers. Drill turns 70' per minute with .007" per revolution feed or 4.277" penetration per minute. Travel, drilling depth including tip of drill, 1/4". Drilling time per row 3 1/2 seconds.

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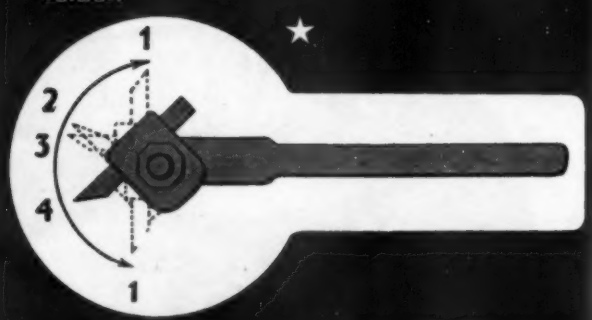

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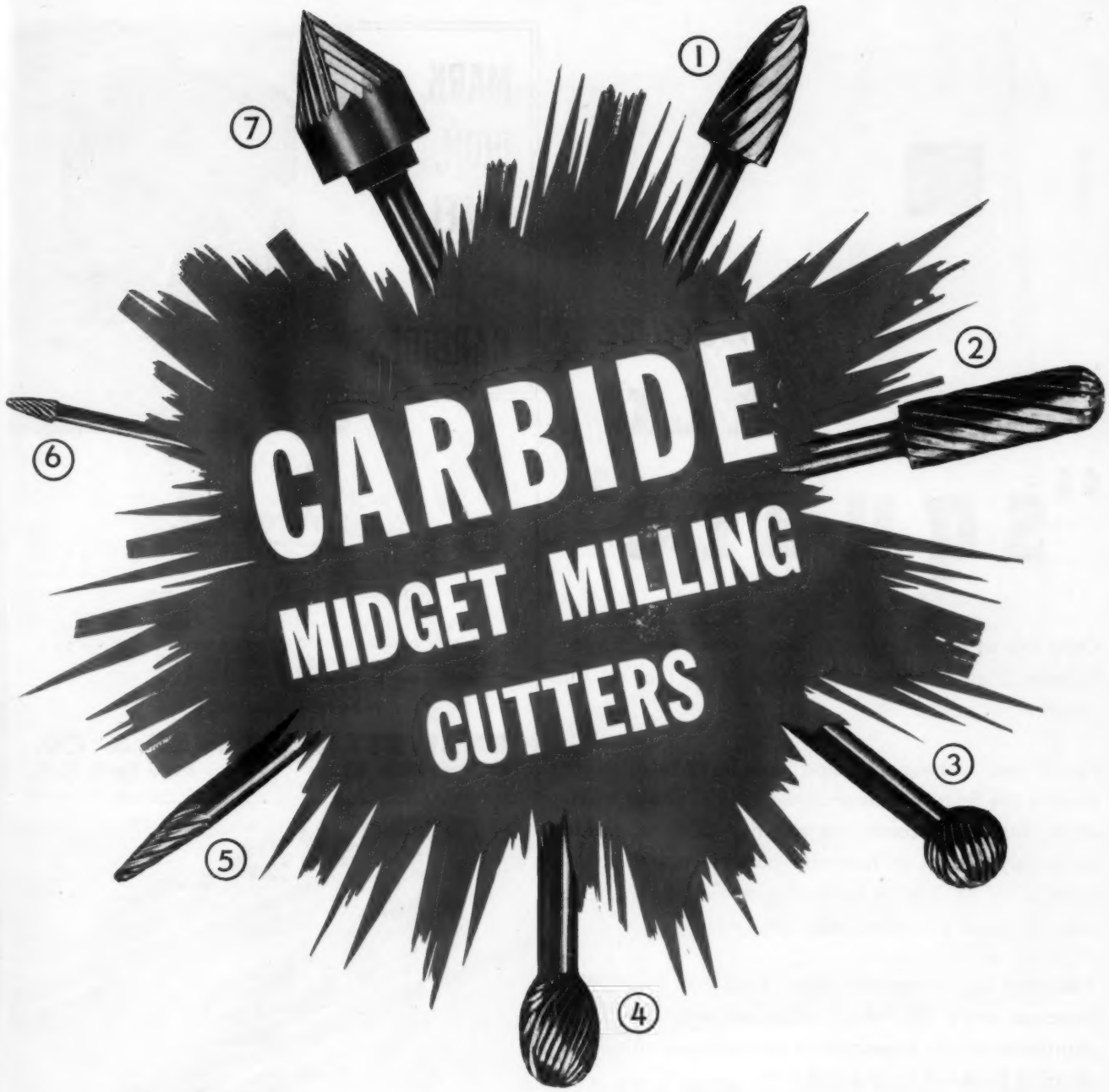

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1	1/2"	1"
2	1/2"	1"
3	1/2"	1/2"
4	1/2"	3/4"
5	1/4"	3/4"
6	3/16"	1/2"
7	3/4" (30° angle)	

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MIDGET MILLING CUTTERS • PRECISION REGRINDING • SEVERANCE TOOL INDUSTRIES, INC., SAGINAW, MICH. • PLANTS IN LONG ISLAND CITY, N. Y.; DETROIT, MICH.; FORT WAYNE, IND.; CHICAGO, ILL.; AND LOS ANGELES

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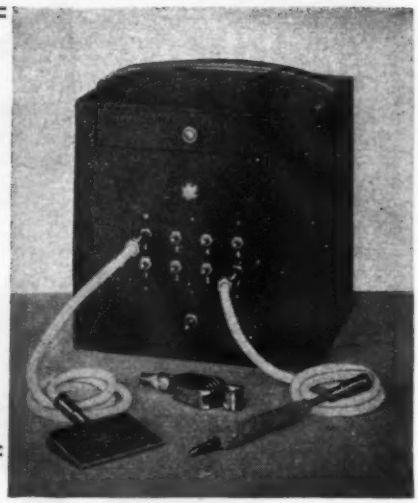

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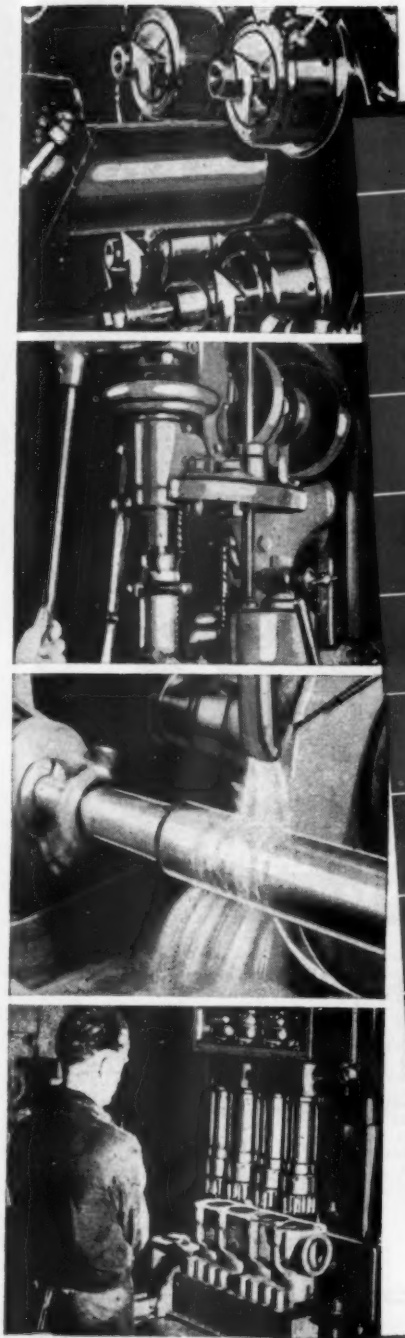

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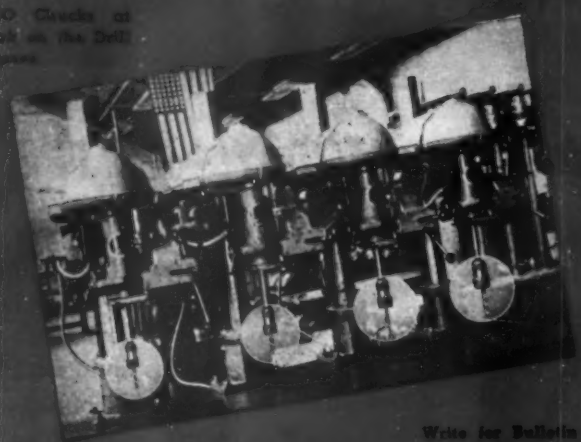

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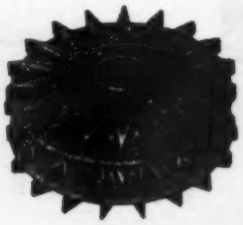

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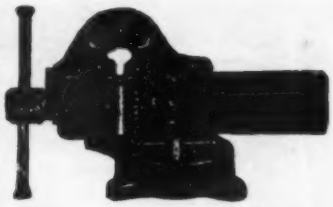

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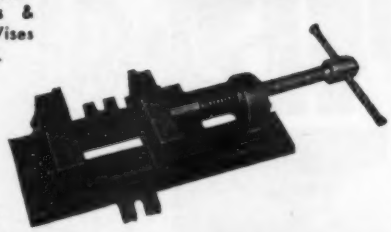

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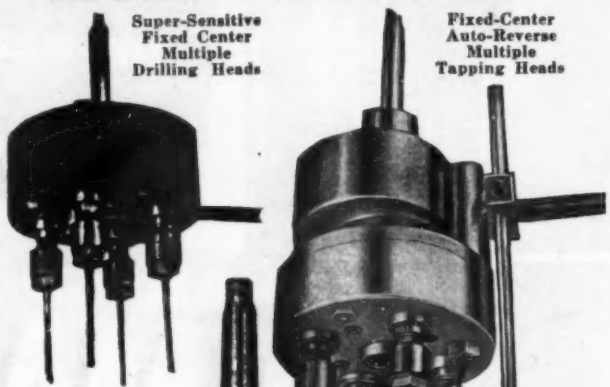

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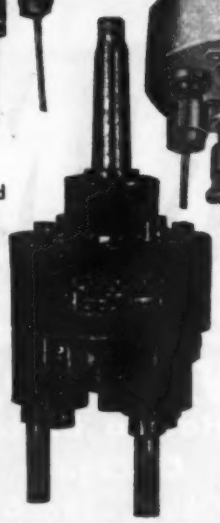

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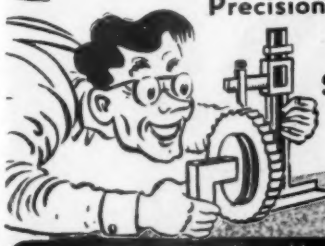

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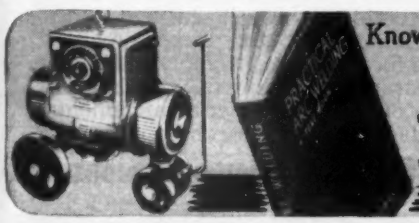

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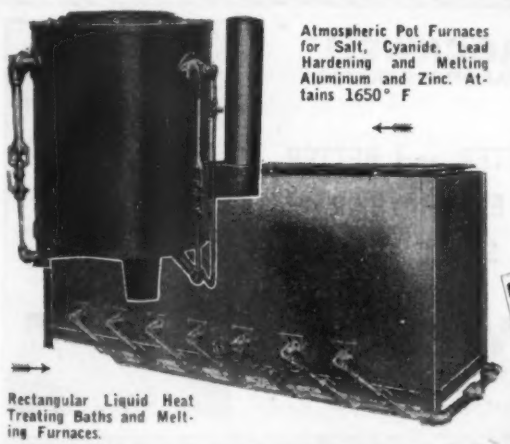

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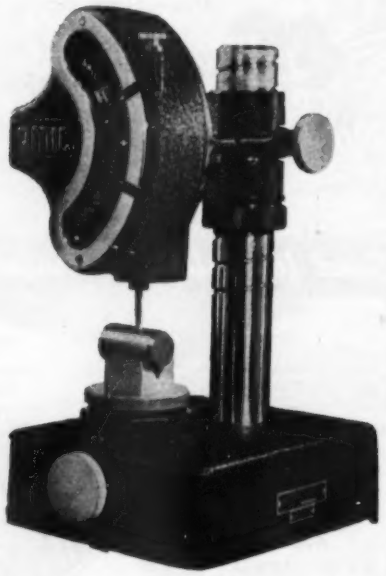

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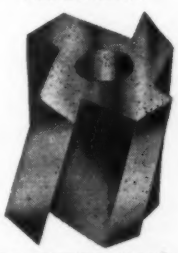
Shaping cutter — can be supplied for any type and size of cut for operations such as beveling, chamfering, rounding, or slotting.

Special high speed steel side mill cutter.



Spiral shaping cutters for routers and shapers. Can be made up to your pattern design.

New 8" diameter Meehanite cast cutter with carbide tips, with 5° negative rake for horizontal milling of long nonferrous extruded beams and forged billets. Tip brazed on casting by high frequency induction heater.

CUTTERS

for High Cycle Routing Shaping Milling

AT HIGH RPM

It is now an admitted fact that the production machining of nonferrous metals is a field all its own. The problems encountered and the methods employed are in great part totally unrelated to ferrous metalworking.

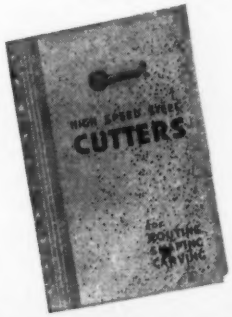
For many years, designing and building nonferrous metalworking cutters as well as machines has been an Onsrud specialty. Our engineers have worked intimately with hundreds of plants helping to provide the practical means to faster, better nonferrous part production. This extensive and unusual experience is now at your service when buying the cutters you need.

Illustrated are a few of the hundreds of types and sizes of cutters and bits that are already standard at Onsrud. Cutters and bits, as well as Onsrud machines are available for milling, routing, and shaping such metals as the aluminum and magnesium alloys. Also available are cutters and machines for making the wood and composition patterns required in numerous modern metalworking operations.

Your inquiry is invited.

ONSRUD MACHINE WORKS, Inc.
3921 Palmer Street, Chicago 47, Illinois
Sales Offices in all Principal Cities

Send for Complete Catalog



Onsrud MACHINE TOOLS AND METHODS FOR TOMORROW'S PRODUCTION

VOTE HERE
This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.
COURT

DEMOCRATS *need "Seed Money," too*

Seed Ideas and Seed Money

Whether you run a whole business, a plant or a section, the very fact that you hold this magazine in your hands indicates that you are interested in *improvement*.

Did you ever stop to think that that instinctive desire to find a better way of doing things is the fundamental driving force of America?

It is.

If allowed to function in an environment economically and politically favorable to industry, this American instinct for improvement can carry us forward to undreamed standards of living and of culture.

The only barrier to constant improvement is lack of public understanding.

Industry cannot have a favorable environment, however, until industry itself clearly defines its objectives, and explains them clearly to every citizen *in terms of social progress*.

This Seed Money advertisement (reprinted from the McGraw-Hill newspaper campaign now running in Washington, New York and Chicago) is intended as a starter in a nation-wide process of education on the source of good living.

Some companies are running the Seed Money Advertisements locally, over their own signatures. Others are starting their own campaigns. Either way, the Seed Idea is being planted.

If you would like to reproduce this message in your plant city, free mats and booklet reprints (sold at cost) are available.

James H. McGraw, Jr.
President

McGraw-Hill Publishing Company, Inc.

NOW don't get excited, folks, this isn't a political advertisement. We've got some thoughts on our mind about how to make big problems simple, and we are using the word "democrat" the way the men who thought it up used it.

More than 2,000 years ago, the Greeks decided to quit believing in Superman, and they invented this word to express their general idea.

► Every schoolboy knows how that idea was pulled off the shelf sometime back, and a form of government hammered out that would allow Joe Doakes enough personal elbow room to do his stuff in the world.

Every schoolboy knows, too, that what followed—particularly in America—was the most rapid development ever known.

Within the memory of living men, we have traded the economy of the hoe for the tractor, the muscle for the motor, the eye for the electronic tube.

So vast has our mechanical might become that by shifting the ends of our production lines from the garage, the kitchen and the living room to the skies above Italy, Germany and Japan, we are changing the history of the whole world.

With all this glory to his credit, wouldn't you think the common man would know how he did it,

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

DEMOCRATS *need "Seed Money," too* (cont'd)

and how to keep on the road to better living after the war?

He doesn't know, because he discounts the part that his own, native love for *improvement* plays in our national life.

This love for *improvement* started on pioneer farms. It continued in millions of garages and kitchens. It rides with every American gunner today.

American *improvement* is essentially a Joe Doakes affair. Here's how it works:

1. Joe invents something and invests Seed Money in equipment and materials to make it.
2. People buy it.
3. That makes good paying jobs.
4. Joe invests more Seed Money to improve his product or his method of making it.
5. More people buy it.
6. That makes more good paying jobs.
7. Joe invests more Seed Money in more and better machines, to get volume production.
8. So, Joe lowers his price.
9. Still more people buy.
10. That makes more good paying jobs.

Try to figure out any other foundation for American wealth, leisure, culture, fighting strength or material possessions!

► This simple progression, multiplied by millions of instances, explains why "Seed Money" is so important in our national life.

Seed Money is used every time a product or a machine is improved, because Seed Money means "that part of profit which is 'plowed back' into a business."

Joe Doakes will need his Seed Money, to attract customers and create jobs when this war is over. But a dangerous percentage of Joe's Seed Money is being blotted up in the Excess Profits Tax.

Perhaps our government intends to return some of this money after the war, as a loan. But this would mean another government bureau, more Federal employees, all of which will further increase the cost of government. But above all—Business will not be free to "take a chance" with this money. It belongs to the government. Hence, the "take a chance" spirit, the life breath of progress, will be hobbled just when Americans need it most.

► There is a simple and much more effective way to supply our American industry and commerce with Seed Money.

Change our tax laws to permit industry and business to set aside from present earnings the tax-free Seed Money that they will need to reinvest in improvement of plant, products or essential operations to create jobs after the war.

To put this simple, effective procedure into practice, our government must change its attitude toward the source of all improvement—Seed Money. To bring this about, remind your Congressman that:

"Industrial Progress is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.00 per 100; $10.00 per 1000.)

McGRAW-HILL

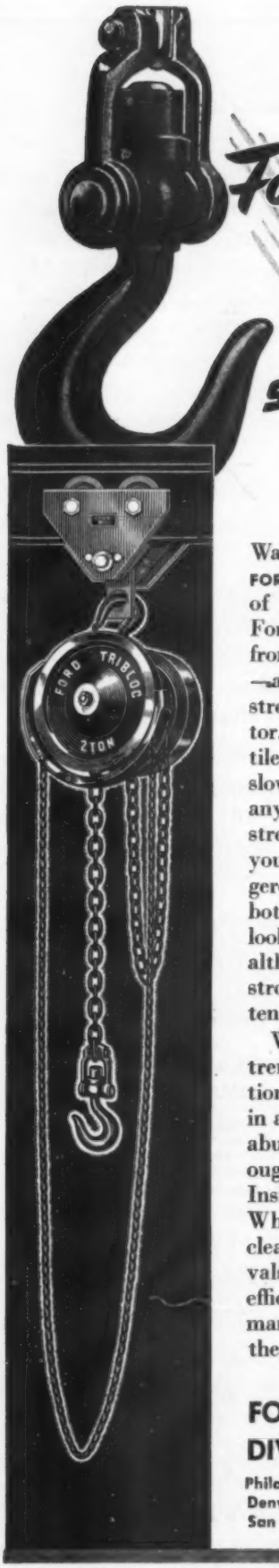
PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK (18), N. Y.

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Air Transport • Aviation • Aviation News • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman

Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation



THE Ford Tribloc HOOK IS LIKE A SAFETY VALVE

Watch the load hook on your **FORD TRIBLOC**. It is your first line of defense against overloading. Ford load hooks are drop-forged from special steel and heat treated —and while they possess ample strength for adequate safety factor, the steel is sufficiently ductile to permit the hook to open slowly without fracture before any part of the hoist is overstressed. **FORD TRIBLOC** hooks are your safety valve against dangerous abuse. . . . And when the bottom hook has begun to open, look to the top hook as well, for although the top hook is even stronger, it, too, may need attention.

With all steel products extremely critical—with production demands at the highest peak in all history—this is no time to abuse machinery. Make thorough inspection a regular routine. Insist upon proper maintenance. When given intelligent care, cleaned and lubricated at intervals, **FORD TRIBLOCS** will remain efficient under hardest usage for many long years. Be sure that they do.

FORD CHAIN BLOCK DIVISION

Philadelphia · Chicago
Denver · Los Angeles
San Francisco · Portland

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT, CONNECTICUT

PAYS FOR ITSELF IN 2½ MONTHS

In 2½ months one manufacturer* saved enough in cutting oil costs to pay for his American Chip Wringer. After that, the saving was clear profit . . . **month after month.**

In less than 3 minutes operating time, an American Chip Wringer reclaims MORE THAN 90% of the cutting oil from metal chips and machine turnings. So, you save valuable oil at the same time you save money.

Any unskilled person can operate an American Chip Wringer. Write TODAY for full particulars.

*Name furnished on request.

American Chip Wringers are available in the following models.
20 30
26 48 40

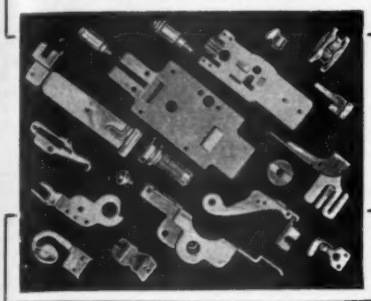
ARMY E NAVY
CINCINNATI PLANT

The AMERICAN LAUNDRY MACHINERY COMPANY
CINCINNATI 12, OHIO

CONTRACT WORK

STAMPINGS AND ASSEMBLIES

Fast Service on Long or Short Runs



"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

ADDITIONAL FACILITIES FOR CONTRACT MANUFACTURING

Hand screw machines up to 1¼ dia.
Turret lathes up to 15" dia.
Milling machines
Engine lathes
Bench lathes
Drill presses
DoAll contour cutting machine

RELIANCE MACHINE & MFG. CO.
30 Irving Place, New York, N. Y.
established 1922

SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .

exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples today for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER

STEEL PRODUCTS CO.
1103 E 23rd St. INDIANAPOLIS, IND.

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.

KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

DESIGN & BUILD
JIGS, FIXTURES & GAGES

REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

• QUALITY •

SCREW MACHINE PRODUCTS

• ● •

WALTHAM SCREW COMPANY
WALTHAM • MASS.

WORK WANTED

Small Brass Foundry Equipped with 14" Lathes and Brown and Sharpe No. 3 Gear Cutter.

DANBURY BRASS WORKS
54 Franklin St. DANBURY, CONN.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us — we will take care of them.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

WIRE AND METAL SPECIALISTS
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

MACHINE SHOP WANTS DEFENSE WORK

Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

STEPHEN J. LEWIS ENGINEERING CO.
215 Butler St. TRiangle 5-5348 Brooklyn, N. Y.

These advertisers invite you to consider their facilities, when placing contracts for work they are especially equipped to do. If you respond to their advertising, please tell them you saw it in

AMERICAN MACHINIST

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, 22 Brown & Sharpe Milling Machine, Drill Press and 8" x 8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO., HOCKESSIN, DELA.

AVAILABLE NOW
CYLINDRICAL GRINDING FACILITIES
Handle Stock to 4" x 13"
IMMEDIATE SERVICE
Let Us Quote You on Turning and Grinding
ACME EQUIPMENT CO.
W. C. Dept.
128 S. Clinton St. Chicago, Ill.

KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR OTHER ALLOY FABRICATION OUR SPECIALTY
CAPACITY ½ AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

SEARCHLIGHT SECTION

CIVIL SERVICE

100 DRAFTSMEN (men and women)—for war work; ship, electrical, mechanical, topographic, statistical, etc. For bureaus of Navy, Commerce and Treasury Depts. and W.P.B. in Washington, D.C. and throughout U.S. Salary range $1,752 to $3,168 a year. Instruction available to beginners or those now in similar work. Announcement 283 and application forms available at first and second-class postoffices. U.S. Civil Service Commission, Washington, 25, D.C.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

WANTED

CHIEF TOOL *and* DIE DESIGNER

To design die cast dies and do general engineering for Die Casting Division of midwestern manufacturer. Some experience in die casting aluminum preferred. Locality and living conditions very good.

P-664, AMERICAN MACHINIST
520 N. Michigan Ave., Chicago 11, Ill.

BUSINESS SOLICITOR WANTED

A Financially Responsible progressive machine shop wants a Business solicitor. Applicant must have a successful record of Business promotion and must be able to figure jobs and have a practical working knowledge of the Business. This position will lead into an executive capacity with the company and offers an excellent opportunity to a man interested in a post war future. When writing give names of previous employers. We will not correspond with your present employer unless you request it.

General Manufacturing Co.
4204 Lyndale Ave. North, Minneapolis, Minn.

WANTED

PRODUCTION MACHINE SHOP

FOREMAN for post war work

Must have record of performance and be able to supervise the design and manufacture of tools and jigs. Handling of men essential. This company is now in war production having Army & Navy "E". Immediate employment could be arranged for right man. Good salary with future. Our peacetime product is sold nationally to one of this country's largest industries. The undersigned is acting as intermediary for the manufacturer, not an employment agency. Your name will not be turned over to prospective employer without your consent. There is no obligation on your part. Reply in detail to GREER McILVAIN, 1341 Oliver Building, Pittsburgh, Pennsylvania.

WANTED

First Class Engineer

with practical experience in Machine Tool Design. One who has something to offer for the Post War Trade and with Horizontal Boring Machine experience preferred.

P-674, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED
PLANT MANAGER

Chicago mfr. Precision Gages, 100-men shop, desires progressive self-starter who gains full cooperation of men. Must be familiar with grinders, screw machines, lathes, etc. 100% war work. Exceptional post-war opportunity. Write or apply for interview. Room 500, 37 West Van Buren St., Chicago.

POSITIONS VACANT

MECHANICAL DRAFTSMAN with practical mechanical experience in blanking, drawing and forming dies for sheet aluminum products in defense plant in Midwest; give experience and full particulars. P-593, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL MAKERS for defense plant in Midwest; give experience and full particulars. P-594, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED: Machine Designer—Experienced on the design of special machinery and machine tools. This is an excellent opportunity for a first class man interested in a steady position in New England. Only men 35-55 with a record of successful achievements will be considered. In replying furnish complete information preliminary to a conveniently arranged interview. P-645, American Machinist, 330 W. 42nd St., New York 18, N. Y.

A-1 Tool and Gauge makers for defense plant, give full particulars and experience. P-665, 330 W. 42nd St., New York 18, N. Y.

MECHANICAL DRAFTSMAN with practical mechanical experience in blanking, drawing and forming dies for sheet aluminum products in defense work by old established company in Central West; give experience and full particulars. P-667, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL MAKERS for defense plant in Central West; give experience and full particulars. P-668, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL AND DIE MAKER wanted by Progressive southern Minnesota War Plant to take charge of tool shop. Must be able to plan and layout dies and jigs. Write P. O. Box 371, Albert Lea, Minnesota giving full details.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 266 Delaware Bldg., Buffalo, N. Y.

POSITIONS WANTED

DESIGNER, experienced on dies, special machinery, and general engineering department work now available for employment. PW-669, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER 18 years experience Design and development of Prod. Mach. and Hydraulics, Shop practice incl. 10 years in Supervisory Cap. Desires new connection with good peace time product Mfg. 3A draft status. PW-670, 520 N. Michigan Ave., Chicago 11, Ill.

MANUFACTURING EXECUTIVE—Plant Manager—General Superintendent. Technically trained mechanical engineer and industrial manager. 12 years managing plants in charge of personnel, cost accounting, production engineering, production control, plant engineering and inspection. 22 years manufacturing experience in—heavy machinery, precision machine tools, high quality diesel and aviation specialties. Inherently mechanical. Successful records for high production and low costs through—time-study, performance standards, standardized tooling and methods, incentive systems. Good on labor relations. Salary $7,000, 42 years old. Immediately available. PW-671, 330 W. 42nd St., New York 18, N. Y.

SALESMAN AVAILABLE

EXPERIENCED INDUSTRIAL SALESMAN and advertiser wishes to become associated with progressive manufacturer. Qualifications based on eight years selling industrial and metal fabricating tools. Have experience and ability to develop sales and advertising department. Age 35 years, draft 3-A. Immediately available with release. SA-672, 520 N. Michigan Ave., Chicago 11, Ill.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Ollwine & Rommel, Suite 453, 815-15th St., N. W., Washington, D. C.

BUSINESS OPPORTUNITY

WORKING FOREMAN to take 25% of Shares in Small Gear Shop—Established 9 years—Practical experience and some technical knowledge required—Factory located in State of New York. BO-673, 330 W. 42nd St., New York 18, N. Y.

WANTED

DISTRIBUTORS AND SALESMEN

COMPLETE LINE OF INDUSTRIAL DIAMOND TOOLS.

RW-663, AMERICAN MACHINIST
330 W. 42 St., New York 18, N. Y.

Party with Machine Shop located in Detroit, wishes to represent and service articles, instruments or devices in the mechanical line, preferably already established.

RA-675, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

EXPORT ORDERS

Machine Tools, Small Tools, Factory Equipment, General Machinery, Machine Products. Manufacturer's Representative, twenty years selling experience in all countries. Last three years contacting all Foreign Buyers and Government Offices. Familiar with Contract Problems and Procurement Procedures. Will represent reputable manufacturers on Commission, Agency or Retainer Basis.
RA-658, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED

NEW INVENTIONS WANTED

Mechanical and electrical devices for post-war manufacture and sale. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

POST WAR PRODUCT

Wanted for purchase or manufacture, by a completely equipped manufacturing plant, which has an excellent sales organization. Write us giving details of your product or item.

BO-627, American Machinist
330 West 42nd St., New York 18, N. Y.

SALES AGENTS WANTED

on Exclusive Basis in Few Choice Territories

KNOCK-OUT KO

K. O. LEE CO.—ABERDEEN, S. D.

Manufacturers of

Universal Tool Grinders, Carbide Tool Grinders, Drill Chucks, Expanding Mandrels, Arc Welders, Valve Seat Grinders, Valve Reface rs, Abrasive Wheel Dressers, Connecting Rod Aligners, Valve Seat Rings, Chuck Centers.

IN STOCK!!!

LATHES

Putnam 30" x 12' Heavy Duty Screw Cutting Engine Lathe, QCG.
Putnam 26" x 12' Heavy Duty Screw Cutting Engine Lathe, QCG.
LeBlond 14" x 6' Toolroom Quick Change Gear Screw Cutting Lathe, with taper attachment, drawbar collets, and two chucks.

PRODUCTION LATHE

2—LeBlond No. 9 Automatic Lathes, capacity 9" swing, 16" between centers, geared head, arranged motor drive with motors for 3 phase, 60 cycle, 440 volt service. Equipment includes back facing attachment, oil pump and piping. New in 1929 and guaranteed in first class mechanical and operating condition. Special price for immediate sale.

TURRET LATHES

ACME 1½" cap., power feed to turret, screw cross slide, bar feed, 6 hole hexagon turret, collets, turret tooling, arranged M.D. 60-3-220/440 volt.
Foster 1" capacity Geared Friction Head, Hand Operated Turret and cross slide, collet, belt drive.
21" Gisholt Universal Turret Lathe with 3¾" hole in spindle, 2-step one for 5" belt.
Jones & Lamson 3 x 36 Double Spindle, air chuck equipment.
Jones & Lamson 3 x 36 Single Spindle, Geared Head, Single Pulley Drive.
Warner & Swasey No. 2 Geared Friction Head Hand Screw Machine. 1" cap.
Warner & Swasey No. 2 Plain Friction Head, Hand Screw Machine, 1" capacity.

FURNACE

1—W. S. Rockwell Revolving Annealing Furnace, Model 701.

BORING MILLS

34" Bullard Vertical Turret Lathe Rapid Production, motor drive.
3½" Rochester Floor Type Horiz. Boring Mill, M.D.
1—Excello Boring Machine, Model No. D-B113-B.

GRINDERS

No. 6 Besley Double Opposed Disc Grinder.
No. 2 and No. 3 Brown & Sharpe Cutter Grinder.
Gorton, double end Disc Grinder, 18" discs.
Greenfield No. 12, Hydraulic Feed, motor drive; cap. swings 15". Grinds automatically ¾" to 5" dl., 4" deep. New in 1928.
36" Blanchard Vertical Rotary Surface Grinder, late model machine.

COILING MACHINES

No. 1 and No. 2 Sleeper & Hartley BX cable coil. mach., ⅜ and ½ in. cap. Last used for speedometer cable. Complete.

DRILLS

Avey-4-spindle, No. 3 high speed, ball bearing, power feed, motor drive.
Leland-Gifford 2-spindle, No. 2 M.T., high speed, ball bearing Drill Press, power feed.
Allen single-spindle, high speed, ball bearing, 8" overhang Drill Press, table 14 x 14.
Avey single-spindle, No. 2 M.T. Toolmakers Drill Press, two tables, like new.
Henry & Wright 6 spdle ⌀3 M.T. High Speed, B.B.
RADIAL DRILL—Bickford 7' arm, 15" round column, gear box motor drive.

HAMMERS

1—1100# Bement & Miles Steam Forging Hammer.
No. 6½ Rochester, High Speed Riveting Hammer.
No. 5½B Rochester High Speed Riveting Hammer.
No. 3A Rochester High Speed Riveting Hammer.

DRILLING MACHINES

Fox No. 15H mult. spdl. drill. mach., Hyd. feed, 35 No. 1 Morse taper Spindles, 17" x 34" bd., ser. No. 1005, M.D., 10 H.P., 3 ph., 60 cy., 220 v.
Fox No. D31 mult. spindle drill. mach. Drilled for 32 spindles and equip. with 16 No. 3 Morse taper Pwr. fd., 17" x 34" bd. Ser. No. 636, m.d. 10 H.P., 3 ph., 60 cy., 220 v.
Natco No 12 mult. spindle drill. mach. Single pulley, B.D., Drilled for 16 Spindles and equip. with 6 No. 2 Morse taper. Power feed.

GEAR SHAPERS

2—⌀612 Fellows—Late type.
1—No. 3 Brown & Sharpe Spur Gear Cutter.
1—No. 13 Brown & Sharpe Spur & Bevel Gear Cutter.

SHAPERS

36" Cincinnati Triple Geared Shaper, Friction Drive.
30" x 20" x 36" N-B-P Shaper-Planer, Arranged Motor Drive.

STRAIGHTENING MACHINE

No. 5-18½ Littell Single Rack & Pinion Feeding and Straightening Machine.

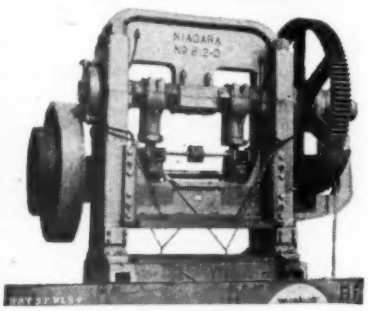
MILLING MACHINES

Cincinnati ⌀3 Vertical Milling Machine, High Power, Power Rapid Traverse. Motor Drive.

Presses, Brakes and Shears

MARIETTA Power Press Brake 104" between uprights. Dual rams to permit operations on separate dies from both sides of press. Bed area 20" x 104", each ram 6¼" x 98". 4" crank shaft, 3" stroke. Excellent condition.
Ohl power square Shear 8' 10 gauge.
No. 132 Bliss 14 ga. 18" throat slitter.
No. 232 Bliss 12 ga. 18" throat slitter.
No. 306 Bliss Straight Side, Tie Rod, 8" stroke, air cushion, motor drive, Press.
No. 3 A Bliss Toggle Press, 5½" shaft, Vee belt Motor Drive.
⌀20 Bliss O.B.I. 2¼" stroke.
Wickes Double End Punch & Shear, 48" th., 1¼" x 1¼" capacity.
100 ton Adriance Straight Side, Single Crank, Single Acting, Back Geared Power Press, 2" stroke, 18 x 18 bed area.
⌀21 Bliss O.B.I. Press, 2½ stroke.
⌀21 Bliss O.B.I. Press, 2" stroke.
⌀20 Bliss O.B.I. Press, 2" stroke.
⌀216 Consolidated Cut and Draw Press, S.S. Die Rod, Plain Flywheel, 5" stroke.

200 TON NIAGARA



1—Niagara ⌀612 D press. Straight side, double crank, back geared, 200 ton cap., 3" stroke, bed 60 x 38.

PLANERS

POND 72" x 72" x 18' table; 2 heads on rail, 2 side heads.
CINCINNATI 30" x 30" x 10' table, M.D.
PUTNAM 48" x 48" x 12' table, M.D.

PROFILERS

P. & W. No. 12 2-spindle motorized Profiler, Table 12" x 15" equip. with 6" rais. blocks, and 5 H.P., 3 ph. 60 cycle, 220 V. motor—Turner drive mounted and wired to push button control—rebuilt and guaranteed.

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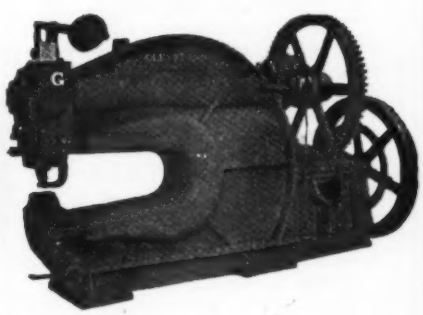
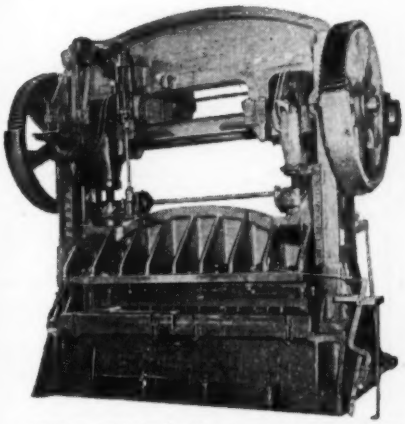
6' x 14 gauge capacity. Ar. M.D.
Working length 72", cap. 14 gauge; min. width of fold at cap. 1" gaging range (narrow folds) ¾" to 1⅝", max. gaging range 72" left of chamfering bar 3". Shipping wt. 13,690 lbs. Like new.

MODEL G CLEVELAND GAP PUNCH



Vertical Cleveland, model G open Gap Punch, 52" throat, arch Jaw, 2" hole thru 1" plate cap. arrange for Gear motor drive. 10 H.P., 3 ph., 60 cy., 220 v.

Toledo 94½-J 200 Ton Press



TOLEDO 94¼-P 200 ton press. Straight side tie rod, double twin, direct geared M.D. with 30 H.P. 3 ph. 60 cy. 440 V. motor & Con. Forced feed lub., pneumatic controlled friction clutch & brakes. Bed area—120" right to left x 50" front to back. 12" stroke, 18" sheet height. Bed equipped with spring cushions. Weight approx. 80,000 lbs.
Sanford No. 1½ Production Miller, Rotary Table.
Cleveland Vertical Miller No. 1 (New.)

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38" x 38" x 12' Gray Planer Type, m.d.
54" Bridgeport Knife, belt

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Gleason Cutter, belt
Gould & Eberhardt Gear Cutter Grinder, belt
Landis Chaser, belt
3" Sellers Drill, belt

KEYSEATERS

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No. 2 Morton, belt
No. 4 Mitts & Merrill, belt
Morton, 1" cap.

ENGINE LATHES

20" x 12' Monarch, m.d. in base, taper
18" x 10' Lodge & Barker, cone
20" x 10' LeBlond, cone
16" x 6' Hendey Yoke Head, m.d., taper
18" x 8' Hendey Yoke Head, m.d., taper
20" x 8' Hendey Yoke Head, m.d., taper
20 x 10' Hendey Yoke Head, m.d., taper
14" x 8' Sidney, m.d.
19" x 8' LeBlond, m.d., taper
16" x 6' Reed-Prentice m.d., taper
25" x 14' LeBlond, m.d.
23" x 16' centers (12' bed) American 100 H.P. Input Super Lathe, with 100 H.P. D.C. motor, equipped with p.r.t., chip conveyor, chip breaker, weight of lathe 45,000 lbs.
22" x 18' Niles, cone
24" x 10' American Geared Head, m.d.
24" x 15' Prentice Geared Head, m.d.
24" x 10' Greaves-Klusman, cone
27" x 16' LeBlond, cone, taper
30" x 14' Lodge & Shipley, m.d.
36" x 10' Putnam, cone
36" x 16' Springfield, cone

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8 x 72" Le Swing, m.d.
8 x 84" Le Swing, m.d.
3½ x 36" Le Swing, s.p.d.
3 x 80" Le Swing, s.p.d.
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11" x 4' Wells Speed
14" x 6' Champion
15" x 6' Automatic Threading, m.d.
15" x 6' Harrington Barrel Turning
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Niles-Bement-Pond Axle Lathe, cone

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No. 4 Cincinnati Plain, vert. overarm, m.d.
No. 5 Cincinnati Plain, vert. overarm, m.d.
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No. 4B Heavy Milwaukee Plain, double overarm, m.d., vert. attach.
No. 5B Heavy Brown & Sharpe Plain, m.d.
No. 3 Brown & Sharpe Plain, cone, motorized
No. 1½ Brown & Sharpe Plain, cone, motorized
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No. 2 Knight Vertical, m.d.
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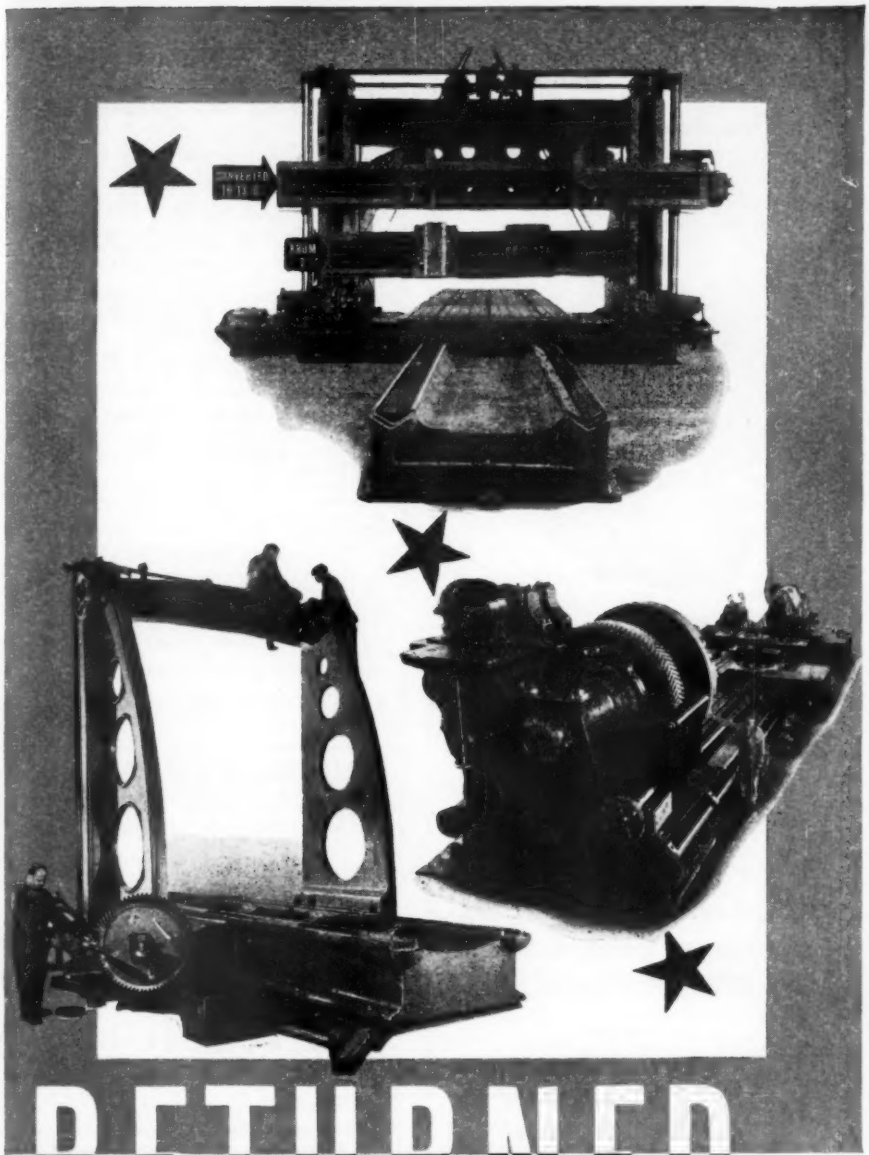

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3 "*Engineered Rebuilts*", veterans of World War I are again serving under our battle flag . . serving as never before, thanks to the skill of Simmons engineers. The capacity of the planer, illustrated top center, was virtually doubled—from 7′ to 13′6″: lower left, 1 40-year-old planer was rebuilt and modernized: lower right, a 495-ton gun lathe, idle for over 20 years, was put back in the fight. Simmons *Engineered Rebuilding* has been and is a mighty factor in the successful prosecution of the war. It will be equally as vital in the re-conversion to post-war. The brochure "*The Simmons Way of Engineered Rebuilding*" is yours for the asking.

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- 4 5/8″ Bar N.B.P. Horizontal Boring Mill, Knee Type, 30″x90″ table, M.D.
- 42″ PUTNAM Double End Car Wheel Lathe, M.D.
- 47″ N.B.P. Double End Car Wheel Lathe, M.D.
- No. 1 L & A Multiple Punch, 100 tons, 72″ between housings
- 6″ x 6″ x 5/8″ Double Angle Shear.
- Beam Shear 20″, 60# and smaller.
- 60″ Throat 8″ x 1 1/16 Shear.
- 54″ Throat 1 3/4″ x 1 1/8″ Punch.
- 3 1/4″ x 12″ TRIPLEX Pumps, 1500 to 2000 lb. pressure, 60 to 70 GPM.
- 15″ GLEASON Bevel Gear Generator.
- 30″ x 30″ x 10′ NEWTON Slab Miller horizontal arbor, M.D.
- 36″ Rotary Planer, M.D.
- 52″ Rotary Planer, M.D.
- 48″ x 48″ x 24′ NBP Heavy Planer, Two Rail, One Side Head, Motor Drive.
- 48″ x 48″ x 20′ PATCH Planer, 4 heads, 230 Volt D.C. Rev. Motor Drive.
- 24″ NEWTON Cold Saw, 7 1/2″ capacity, M.D.

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Putnam 24"x24' LCG.
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J & L 3"x36" Flat Turret.
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Hendey No. 3 Oscillating.
Pratt & Whitney 2" Spline Duplex.
Pratt & Whitney 4⅛"x12" Thread.

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Pond 38"x38"x10'; 38"x38"x13'.

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Manville No. 4 D.A. Pillar Crank.
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26" x 10' Niles, Cone, Q.C.
18" x 8' Lodge & Shipley Q.C.
14" x 6' Lodge & Shipley Cone, Q.C.
20" x 9' Rahn Larmon, Cone, Q.C.

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Lees Bradner Gear Grinder.

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24" x 24" x 6' Gray Planer.
28" x 28" x 8' Whitcomb Blaisdell Planer.

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3' American Plain.
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Drill, 29" Barnes A.G.S.O.
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Drill, Rohnberg-Jacobsen, 16 spdl. production
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Gear shaper, Z3 (No. 624) Fellows
Gear hobber, No. 16 HS Gould & Eberhardt
Grinder, No. 3 Cincinnati universal
Grinder, No. 84 Gardner, 24" opposed spindle
Grinder, Landis 10" x 48", 12" x 36", 16" x 52"
Grinder, Landis 16" x 32" & 16" x 48" crankpin
Grinder, 20" x 50" Safety Emery Wheel surface
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Lathe, 14" x 10" Fay automatic
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Miller, No. 4 Cincinnati
Miller, Type C Hall Planetary thread
Miller, No. 3 Turn Millers
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Press, No. 3-7 Zeh & Hahnemann str. side
Press, No. 33 Toledo arch
Presses, Nos. 180 & 79615 D Toledo, toggle drawing
Presses, Nos. 101 & 103 General Flexible
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Upsetter, 4" Ajax
Welder, 150 KVA Swift, flash or butt

MISCELLANEOUS

Casing coiler, ⅝" No. 319 Sleeper & Hartley
Spring coiler, No. 3, ⅝" capy. Sleeper & Hartley
Hone, No. 211 Barnes
Lathe, Melling 6 cyl. crankshaft
Sand Mixer, Baker Perkins
Screw Driver, No. 61AA Bodine
Washer, Blakeslee metal
Wire machine, ⅝" x 2" Shuster
Threader, 1" Cleveland automatic double end
Gear checker, National Tool, for gears & cutters
Grinder, Cincinnati face milling cutter
Buffer, Hawes No. 375 for polishing
Die Casting Machine, A. C. Spark
Screw driver, Model C Detroit
Tester, 60,000 lb. Tinius Olsen drop
Washer, Blakeslee, conveyor type

If you do not find the machine you need listed herein, mail us your inquiry and specifications. We may have or know of that very machine

Ask for Your Copy of Stock List No. 175

MILES MACHINERY CO., SAGINAW, MICH.

OTT MACHINERY SPECIALS

AUTOMATICS, Gridley, 1¼, 1⅝ & 2¼" Model F.
AUTOMATICS, Gridley, 2¼, 3¼, 4¼ & 5¼" S.S.
AUTOMATICS, Cleveland, 1⅛, 2⅝ & 3⅝" Mod. A
AUTOMATICS, Cleveland, ⅞, 1¼, 2 & 2½" Mod. B
AUTOMATICS, Gridley, ⅝" Model F, M.D.
AUTOMATICS, Potter & Johnston ₴5A & 6A
BORING MILLS, 42" Gisholt, 1 Turret & S.H.
BORING MILLS, Lucas Horiz. 3" bar M.D.
BORING MILLS, Rockford Horiz. Radial M. D.
GEAR HOBBERS, 12 Barber-Colman M.D.
GEAR SHAPERS, ₴7 High Speed, M.D.
GRINDERS, Landis, ₴1 Universal
GRINDERS, Norton, 14x36" Plain, M.D.
LATHES, 16" x 6' Prathold with Believing Attachment
LATHE, Steinle Turret, 24" with 4" & 6¼" Hole through Spindle
MILLING MACHINE, ₴8 Becker Duplex, M.D.
MILLING MACHINES, Becker Vertical, Model S. D. 40" Rotary Table
MILLING MACHINE, ₴3 Milwaukee Plain, M.D.
PLANERS, 42x42"x12' Ohio, 1 Head, M.D.
PRESSES, Toledo, ₴34 Solid Back, S.G.
PRESSES, Toledo, ₴5 Open Back Inclinable

OTT MACHINERY SALES, INC.
542 Second Ave. — Detroit, Mich.

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH **HYMAN** & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

5' Radial Drill, Bickford, M.D.
26" x 14' Bridgeford Geared end Lathe.
₴14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
24" Gisholt Turret Lathe, 6¼".
20"-24"-32" Shapers.
10' Bridgeport Knife Grinder.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater 2" x 20".

West Penn Machinery Company
1210 House Bldg. — Pittsburgh, Pa.

BORING MILL, 42" **BULLARD** Rapid Production, 1 turret head, 1 swivel head, motor drive.
GEAR PLANERS, Bevel 36" & 54" **GLEASON**.
PRESS, Double Crank 95-B **TOLEDO**, bed area 55" x 54", tie-rod, stroke 3", motor drive. M.D.
PRESS, Hydraulic 1000 ton **WOOD** Platen 42" x 9', stroke 18", daylight 36", motor drive.
PRESS, Toggle No. 14 **BLISS**, bed area 48" x 52", tie-rod, stroke 26", motor drive.
TURRET LATHE, 3-A Warner & Swasey Universal Hollow Hexagon Geared Head, H.S. 3 11/16", S.P.D.
TURRET LATHE, 26" **LIBBY** "C" Geared Head, H.S. 7½", S.P.D.
TURRET LATHE, 34" **GISHOLT** "K", H.S. 4¼", M.D.

Lang Machinery Company
28th St. & A.V.R.R. — Pittsburgh, Pa.

SEARCHLIGHT SECTION

CAN SHIP FROM STOCK

MILLERS
1—#3 Cincinnati High Power
1—#3B Heavy Brown & Sharpe M.D.
2—#4 Cincinnati High Power
1—#2 Cincinnati High Power
1—#2 Van Norman
1—#3H. Le Blond Universal
8—Production Millers

GRINDERS
1—Modern, Cylindrical 18"x80" M.D.
1—Diamond Surface 36"x12"x14"

BORING MILLS
1—54" Colburn, 2 swivel heads on rail
1—48" Colburn, 2 swivel heads on rail
1—42" Baush, 2 swivel heads on rail

RADIAL DRILLS
1—5" Cincinnati Bickford
1—6" Niles Universal Arm.

AUTOMATICS
6—#00 Brown & Sharpe
2—#00G Brown & Sharpe
1—6 spindle new Britain 1¼" cap.

MISCELLANEOUS
Rafter 3,-5,-7, & 8 Head Metal Moulding and Rolling Machines

This is a partial list. Send us your inquiries. What have you to sell? Send us your list.

S. & S. MACHINERY CO.
207 Centre St., New York 13, N. Y.
Phone: WOrth 4-5710

BORING MILL

4½" NILES BEMENT POND DUPLEX CONTROL HORIZONTAL BORING MILL. Table type. DC motor drive. Excellent condition.

J. L. LUCAS & SON, INC.
Bridgeport 5, Conn.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DeWITT TOOL COMPANY
173 Grand St. New York City

Four Automatics

Cleveland 1¼" Model A
Each $1500

These machines have been reconditioned and running on regular production jobs.

LINCOLN FORGING COMPANY
618 St. Antoine Street
CAdillac 1507
DETROIT MICHIGAN

---

3 1½" 8 Spindle Conomatics — New 1940

2 1¼" Gridleys Model F—Motorized

2½" Model B Cleveland

42" Bullard Vertical Boring Mill with One Swivel Head and One 5 Hole Turret Head on Rail. M.D.

32"x18' Rahn-Carpenter Lathe, 13' Centers

24"x14' Porter Lathe

26" Libby 7½" Hole

No. 6 Fellows Gear Shaper

No. 2 Cincinnati Plain Mill

No. 3 Cincinnati Plain Mill

¾"x¾"x24" Punch & Shear

All above Machines in stock, available for immediate delivery.

THE AMERICAN MACHINERY CO.
1693 Lockwood Ave.
EAST CLEVELAND, OHIO

BORING MILLS

10', 60" Niles Vert.
3½" Rochester, M. D.
4", 4½" Gisholt and Niles
54", 60" Colburn, M.D.
36" Niles, Bausch
36" Bullard, V. T. L., M.D.
42" Bullard, M.D.
2½" Gid. & Lewis, Binsee, M.D.

CANAL MACHINERY COMPANY
176 LAFAYETTE STREET, NEW YORK, N.Y.

12" x 42" Landis Universal Cylindrical Grinder

Belt driven with overhead countershaft. Now connected to power ready for inspection — $1450.00.

James L. Taylor Mfg. Co.
Poughkeepsie, N. Y.

HYDRAULICS

1—W-P 1000 ton press, 20" ram, 7" stroke
1—500 ton press, 15" ram, 16" stroke, 28 x 24" platen
1—Oilgear Pump, 23 GPM 1100# W.P.
1—Elmes 1½ x 4" Horiz. 4 plunger pump, 6½ GPM, 5000# W.P.
1—W-F High-Low Pump 60 GPM at 300#, W.P., 3 GPM, 6500 High W.P.
1—Triplex Pump 1 x 5, 1000 cu. in., 6000# W.P.

AARON MACHINERY CO.
1st CROSBY STREET NEW YORK N.Y.

MACHINERY FOR SALE

3 SINGLE SPINDLE 2¼" CAPACITY GRIDLEYS, 1ST CLASS CONDITION.

UNION PARTS MFG. CO., INC.
125 Ashland Place
Brooklyn 1, New York

FOR SALE

1—Warner & Swasey #2 Hand Screw Machine—⅞" Bar Capacity.
1—Superior #3 Hand Screw Machine—1¼" Bar Capacity.
Both machines in good shape. Both machines equipped complete for bar work.
WAYNE MANUFACTURING COMPANY
Honesdale, Pa.

SEARCHLIGHT SECTION

. . . . *(Classified Advertising)* . . . .

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(Used or Resale)

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UNDISPLAYED RATE

10 cents a word. Minimum charge $2.00.

POSITIONS WANTED (full or part time individual salaried employment only), ½ the above rates payable in advance.

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The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH measures ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by October 1st will appear in the October 14th issue, subject to limitation of space available. A.M.

20′ BARNES HONING

IMMEDIATE DELIVERY FROM OUR STOCK

PRACTICALLY NEW

No. 6 BARNES HYDRAULIC HORIZONTAL HONER

6″ diameter capacity.

20′ spindle stroke.

Table working surface 22′ x 40″.

Maximum swing 40″.

This machine is complete with extra hones, blades, cradle supports, extension bars, Vickers hydraulic pump and coolant motor and pump.

We invite your personal inspection.

Wire — Write — Phone

LOUIS E. EMERMAN & COMPANY
MACHINERY

875 W. 120th STREET **CHICAGO 43, ILL.**

REBUILT PLANERS AND LATHES

AVAILABLE FOR IMMEDIATE INSPECTION AND DELIVERY

1—48″x36″x18′ Detrick & Harvey Openside Planer
2—42″x42″x12′ Pond Heavy Duty Double Housing Planers
1—36″x36″x12′ Betts Heavy Duty Double Housing Planer
1—36″x36″x10′ Gray Heavy Duty Double Housing Planer
1—24″x24″x 6′ Gray Double Housing Planer
1—24″x12′ Putnam Engine Lathe
1—20″x10′ Flather Engine Lathe
1—20″x 6′ Flather Engine Lathe
1—18″x 6′ Monarch Engine Lathe

ATLANTIC MACHINERY CORPORATION

149 BROADWAY **NEW YORK, N. Y.** **WOrth 2-0662**

UNUSUAL VALUES

Bolt Cutter 1″ capacity, 3 spindle
Brake Robinson 5′ toggle
Compressor-Quincy 4½ x 5 motor drive
Drill, new 10″ Buffalo bench
Drill, ceiling suspended, unlimited drilling area
Drill Press, 20″ three spindle Barnes
Drill, six-spindle Henry & Wright, 13″ overhang
Drill, two spindle sensitive, #1 Morse taper
Grinder #30 Bryant deep hole internal
Grinder 60″ plate
Grinder #60 Heald, cylinder
Grinder, Nellers Tool
Lathe 14″ x 12′ Lodge-Shipley grd. hd. s.s. mtr. dr.
Lathe, 24″ x 18′ Sieptoe-McFarlan
Motors—new ½ to 30 HP 3 phase ball bearing
Press #8-7 Zah-Hahnemann straight side grd.
Punch & Shear ⅞″ capacity Rock River
Punch & Shear, two ½″ capacity
Threading Machine #0 Webster & Parks
Turret Lathe L & D brass, cross slide turret
Vacuum Cleaners, heavy duty for shop use

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

4-spindle No. 2 Avey Drill
4-spindle No. 2 Allen Drill
2¼″ J & L. motor driven
No. 2 P & W Shaving Machine

D. E. DONY MACHINERY CO.
47 Laurelton Road Rochester, N. Y.

Before you buy, sell or exchange machinery of any kind contact us first.

PAUL'S MOTOR & MACHINERY SUPPLY
6111 Vermont Ave.
DETROIT, MICH.

NILES-BEMENT-POND Horizontal Boring, Drilling & Milling Machine, 4½″ bar, table type, with auxiliary table, motor drive.

No. 5 BAKER BROS. Keyseater. Capacity to cut keyways 4″ wide by 30″ long.

ALSO MANY OTHER TOOLS

ALEX ZEEVE & COMPANY
2269 Woolworth Building New York, N. Y.

—NOTICE—

Our Rebuilding Facilities Are Now Available for Your Machine Tools

The same service that has given ADAMS REBUILT machine tools top recognition by the country's leading manufacturers.

Our service consists of complete dismantling and inspection by competent personnel, replacement of worn parts, resurfacing and hand scraping, refinishing and reassembling. Testing under power to assure both operation and accuracy equal to a new machine tool.

This service is available at a low cost basis. We invite your inquiries or inspection of one of the most modern rebuilding facilities in the country.

ADAMS MACHINERY COMPANY

114 S. CLINTON STREET **CHICAGO 6, ILLINOIS**

TANKS from Tank Cars

Large quantity

8,000-gallon — 10,000-gallon

Built for 60# Hydrostatic and 25# Air Tests. Cleaned—Tested—Painted

Special Notice: What would **PORTABLE** storage of your Liquids save you? Ask our proposition on **WHOLE CARS!**

●

Also TANKS, Commercial. Vertical and Horizontal

From 2879 to 12,500 gals. and even much larger.

IRON & STEEL PRODUCTS, INC.
38 years' experience
13498 S. Brainard Ave., Chicago 33, Illinois
"ANYTHING containing IRON or STEEL"

AS YOU NEVER DROVE BEFORE!

Many a soldier owes his life to a commander who drove him to the utmost in battle—*never let him slacken for a single fatal instant!* And after the war, many a worker will owe his economic safety to a leader who drove him continuously for higher Pay-Roll allotments for the purchase of War Bonds!

Despite higher taxes and prices, the average worker still has more money than ever before—particularly on the basis of the *family* income. With others in the family earning, too, just let the worker 'figure it out for himself', and he usually will realize that *now* he can put more into War Bonds than he has been doing.

That's why the Treasury Department has set new quotas for the current Pay-Roll Allotment Drive—*quotas running about 50% above former figures.* These quotas are designed to reach the *new* money that's coming into the family income. Coming from millions of new workers . . . from women who never worked before . . . from millions who never before earned anything like what they are getting today!

The current War Bond effort is built around the *family* unit, and the Treasury Department now urges you to organize your War Bond *thinking*—and your War Bond *selling*—on the basis of your employees' *family* incomes. For details, get in touch with your local War Finance Committee which will supply you with all necessary material for the proper presentation of the new plan to your workers through your labor-management committees.

Today about 30,000,000 wage earners, in 175,000 plants, are buying War Bonds at the rate of nearly half a billion dollars a month. Great as this sum is, *it is not enough!* So turn-to today! Get this new *family income plan working!*

This Space Is a Contribution to America's All-Out War Effort By

AMERICAN MACHINIST

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he's calling his shots

ARE YOU?

● HE is our Army, Navy and Marines. The job they are doing is bringing us closer to a "peace-work" job, faster than we had dared hope for. Peace, when it comes, lasts for only a few minutes of whistle-blowing and bell-ringing. This is the signal for American business to take the ball and score—or (pray, no) fumble and stumble in a muddle of our own making. HIS clear sights are pointed to the green lights of all-out peace-time production and prosperity. American bombardiers are "on target". Are you? Call your shots, Mister Businessman. Call on LeBlond NOW for improved turning equipment.

THE R.K. **Le BLOND** MACHINE TOOL CO., CINCINNATI, 8

NEW YORK 13, 103 Lafayette St. CAnal 6-5281

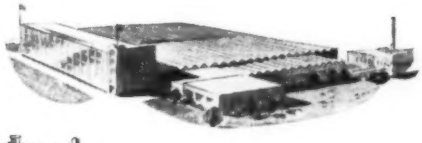
CHICAGO 6, 20 N. Wacker Dr STA 5561

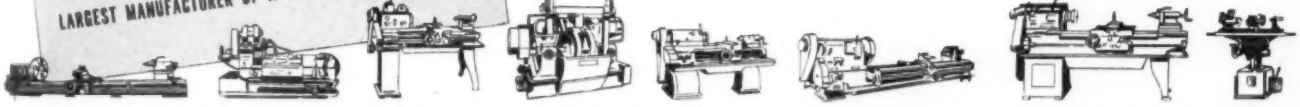
time to retool

Turn to Le Blond for Turning Equipment

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

ARMY E NAVY — LE BLOND — 10





HD Engine Lathes—Nine sizes ranging from 12" to 50" swings. For versatility in turning.

Automatic Lathes—12" & 16" Mechanical or Hydraulic power.

Super Regal Lathes—Six sizes, 13" to 24" Best for training.

Automatic Crankshaft Lathes—For all facing, turning, finishing, pins.

Tool Room Lathes—12", 14", 16" and 18" swings. Versatile.

HD Gap Lathes—Ten sizes in Regular and Sliding Gap models.

Rapid Production Lathes—13", 17", 20" swings. Six speeds. Faster output. Lower cost.

No. 2 Cutter Grinder—Internal, cylindrical, face and angular work.

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FOR ILLUSTRATED SPECIFICATIONS:

- ☐ HEAVY DUTY GEARED HEAD ENGINE LATHES
- ☐ TOOL ROOM LATHES
- ☐ AUTOMATIC LATHES
- ☐ HEAVY DUTY GEARED HEAD GAP LATHES
- ☐ SUPER REGAL GEARED HEAD LATHES
- ☐ RAPID PRODUCTION LATHES
- ☐ AUTOMATIC CRANKSHAFT LATHES
- ☐ No. 2 CUTTER GRINDER

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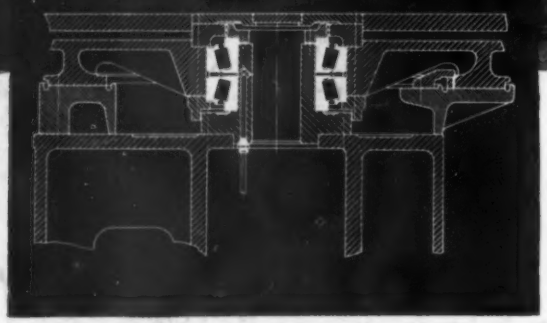

Application of Timken Bearings in the work table of the Cincinnati Hypro Vertical Boring Mill.

This Cincinnati 6-foot Hypro Vertical Boring Mill is installed in a United States Navy Yard machine shop, where its consistent precision performance helps to keep things moving Navy fashion—on schedule.

Prominent among its important hypro features of design and construction is the mounting of the work table on Timken Tapered Roller Bearings. This assures maximum table rigidity and accuracy, with frictionless, power-conserving operation. All loads —radial, thrust and both together are carried by the Timken Bearings, thus increasing endurance and reducing maintenance cost.

No matter what the bearing requirements may be — in machines of any kind — Timken Bearings will meet them with top-notch efficiency. The Timken Roller Bearing Company, Canton, Ohio.

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TAPERED ROLLER BEARINGS